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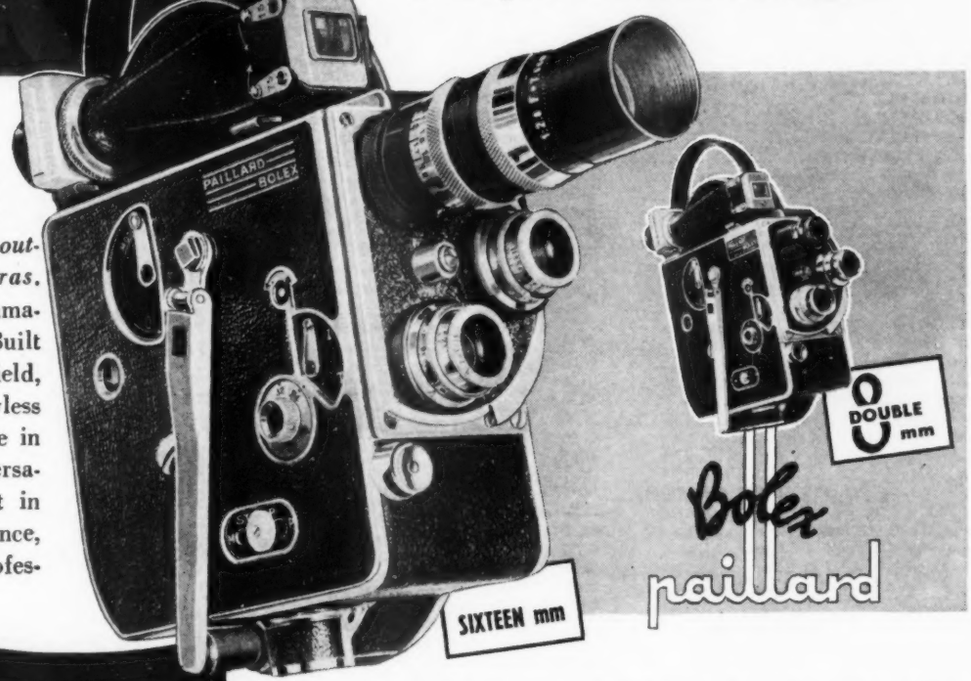

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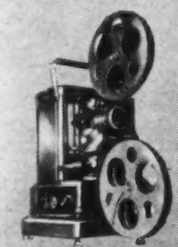

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9x12 cm Kodak Recomar F4.5 KA Comp.	42.50
4x5 Speed Graphic F4.5 Tessar Compur	65.00
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only $6.95 for the **KALART**

COMPAX SPEED FLASH

For all automatic self-setting shutters. A real quality flash.

Other Kalart Models from **$7.95**

● New Voigtlanders

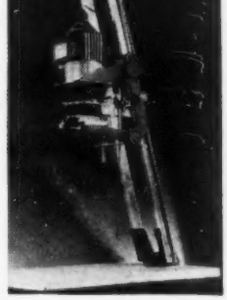
	List	Our Price
Baby Bessa Jr. F3.5	$29.50	$22.50
Baby Bessa F3.5 Skopar, Compur	55.00	36.50
2¼x3¼ Bessa F4.5 Voigtar, Compur	35.00	22.50
2¼x3¼ Bessa F4.5 Voigtar, Compur R	37.50	26.25
2¼x3¼ Bessa F4.5 Skopar, Compur	43.50	29.00
2¼x3¼ Bessa F4.5 Skopar, Compur R	47.00	31.50
2¼x3¼ Bessa F3.5 Skopar, Compur R	52.50	35.00

● New Zeiss Cameras

Tenax I F3.5 Novar	$ 60.00	$ 37.50
Tenax II F2.8 Zeiss Tessar	171.00	105.00
Tenax II F2 Zeiss Sonnar	207.00	125.00

For Needle-Sharp Enlargements

OMEGA



You get precision control plus extraordinarily fine results in your enlargements when you use an Omega. Check these features: Inclined steel girder construction, dustproof negative holder, double condensers, scientifically cooled lamphouse. Negative focusing (in Super Omegas).

OMEGA A 35mm—takes negatives up to 24x36mm, without lens	$ 46.35
SUPER OMEGA B (illus.) for film up to 2¼x2¼, without lens	80.55
SUPER OMEGA C—for film up to 3¼x4¼, without lens	121.05

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142 FULTON ST. NEW YORK, N.Y.

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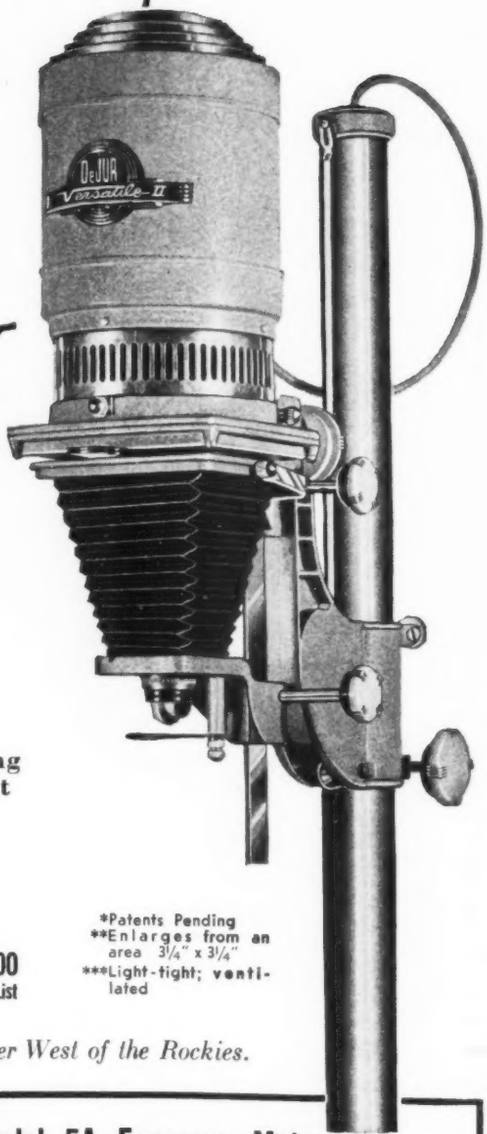

DeJUR "Versatile II" ENLARGER*

(Trade Mark, Reg. U. S. Pat. Off.)

$59.50 List — *For All Standard Film Sizes Up to 3¼ x 4¼ Inches***

- Superb, die-cast construction
- "Aero-Teck" ventilation***
- Two 5" plano-convex condensers
- Heat-absorbing filter
- Interchangeable lens-board
- Right and left-hand controls
- Extra long bellows
- For wall projection
- For color work
- For photomicrography
- For copying and title-making
- Ball-bearing weight support
- A 2¼" x 3¼" view camera
- Dustless negative carriers
- Fully guaranteed

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With negative distortion correction and negative focusing. Complete with dustless negative carrier and center-drilled interchangeable lens-board ..... **$85.00 List**

*Patents Pending
**Enlarges from an area 3¼" x 3¼"
***Light-tight; ventilated

PLEASE NOTE: Prices on DeJur "Versatile" Enlargers are $2.50 Higher West of the Rockies.

DeJUR "CRITIC" Model 40 Exposure Meter

$16.50 (Custom Designed Ever-Ready Case, $1.50)

A meter that challenges all others in the field for performance, sensitivity and instant ease of use. Compactly built, beautifully designed—it's the *one* meter that you can use with complete confidence for every picture-making situation.

DeJur Instantaneous Reading "Critic" Cine Model 40-C Exposure Meter; especially designed for moving picture work, $16.50.

DeJUR Model 5A Exposure Meter

$12.50 (Pigskin Zipper Case, $1.25)

Moderately priced, the DeJur Model 5A is your best bet in the popular-priced exposure meter field. Whether you use it for full color or black-and-white, still or movies, indoor or outdoor pictures—you can be sure, because it's made by DeJur.

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STARTING JULY 1st!
DeJUR PICTURE CONTEST!
Ending September 30th!
Over 50 Prizes!
Total Worth Over $1,200
Open to All Fans!

Nothing to buy in order to enter the contest. No strings attached. Prizes will be awarded for both contact prints and enlargements. See your dealer, or write to the DeJur-Amsco Corporation, Shelton, Conn., for entry blank and full details.

EXTRA! EXTRA!
In addition to the other prizes, there will be a Special Award of a FREE SCHOLARSHIP to the nationally famous New York Institute of Photography

Consult Your Local Dealer, or Write for FREE Folders, Dept. PP-8

DeJUR-AMSCO CORPORATION SHELTON, CONNECTICUT

Fotoshop

A personal letter to the 228 People who are going to win prizes in the $6,000 Popular Photography Contest

Fotoshop Inc.

18 EAST 42nd STREET, NEW YORK, N. Y.
BRANCH 136 WEST 32nd STREET

Dear Prospective Prize Winner:

You're going to a lot of trouble to make that prize-winning picture. But that Popular Photography prize will certainly make it worthwhile, won't it? Well this will let you know that you can also make yourself eligible for another prize--a gift from FOTOSHOP--if you're a FOTOSHOP patron. Yes, if you're the first prize winner in the black-and-white class, in addition to that swell Packard, you'll get a deluxe Kodak Ektra from FOTOSHOP--and it won't cost you a penny. Just on the right, you'll find a complete list of prizes including a National Photocolor camera which FOTOSHOP will give to all winners who are also FOTOSHOP patrons.

How do you become a FOTOSHOP patron? A $2.00 purchase after June 10, 1941 makes you one and puts you in line for those $1100 in extra prizes. Roy Pinney, Glen Fishback and four of the other 50 prize winners in the recent Pop Photo Flash Contest received extra bonuses for shopping at FOTOSHOP. Why not you in this contest?

Just one more thing--when making that purchase (store or mail) be sure to register your name with us as an entrant. And good luck!

P.S. Mail coupon below for entry blank or visit one of our two New York stores.

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Learn HOW YOU CAN win $1100 in extra Fotoshop prizes WITH NO EXTRA EFFORT

145 PRIZES • BLACK-AND-WHITE CLASS

1st PRIZE (KODAK EKTRA, F3.5 LENS)		$235.00
2nd Prize		100.00
3rd Prize		50.00
4th Prize		25.00
5th Prize		10.00
6th— 10th	(5 prizes) each	5.00
11th— 25th	(15 prizes) each	4.00
26th— 50th	(25 prizes) each	3.00
51st— 85th	(35 prizes) each	2.00
86th—145th	(60 prizes) each	1.50

In Merchandising Certificates

83 PRIZES • COLOR CLASS

1st PRIZE (NATIONAL 2¼ × 3¼ COLOR CAMERA)		$115.00
2nd Prize		50.00
3rd Prize		25.00
4th Prize		15.00
5th Prize		10.00
6th—10th	(5 prizes) each	5.00
11th—20th	(10 prizes) each	4.00
21st—35th	(15 prizes) each	3.00
36th—55th	(20 prizes) each	2.00
56th—83rd	(28 prizes) each	1.50

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Includes articles by Willard D. Morgan and Paul Outerbridge which give you many valuable tips—tips that may help you win! 192 LARGE pages also feature all LATEST cameras, enlargers, filters and other photo equipment—help you to correctly choose what you need to make better pictures. You also get hundreds of useful facts and formulas that you need in your work. This prize-winning book, easily worth $3.00, can be yours FREE if you act today! See coupon for further details.

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Insures extremely accurate color values, avoids distortion of highlight tones. Same method as used by leading photo engravers and studios. Contact separations $4.50; enlarged separations up to 4x5" from 35mm or Bantam transparencies, $5.50.

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Possessing fine grain, speed and brilliant contrast, this new high speed film is admirably suited for general outdoor use. Amply sensitive to most colors, you'll like it for your outdoor portraits, summer landscapes, etc., Weston speed is 16° outdoors, 6° indoors.

$2.95 per 100 ft. 16mm roll.

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If you can use a moderate speed film (Weston 12° outdoors, 8° indoors), this new extraordinary fine grain film will give you movies of real professional "theater" quality. In addition to its unusual high color sensitivity, Fine Grain Pan's wide latitude affords ample protection against exposure errors.

$3.25 per 100 ft. 16mm roll.

Above prices include FREE processing.

Also WORLD'S FASTEST FILM LIGHTNIN' PAN

Tremendous speed of Weston 200° outdoors, 100° indoors opens many new possibilities of movie making heretofore impossible because of light conditions.

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Price includes processing.

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REALLY 6 FILTERS IN 1

1. Eliminate reflections.
2. Get clouds in your pictures.
3. Cut down glare.
4. Darken skies.
5. Deepen blue of skies with Kodachrome.
6. Two in combination may be used as a neutral density filter.

COST NO MORE THAN REGULAR FILTERS!

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NEW WILLO FILTO-KLEEN WATER FILTER

A necessity in every darkroom

With the new Willo Filto-Kleen on your darkroom faucet, you will always enjoy absolute freedom from water impurities.

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LIBERAL ALLOWANCE

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BESSA

With F4.5 Skopar Lens In Compur Shutter

$33.00 Formerly $44.50

A light, compact two-size camera with speeds up to 1/250th part of a second. Enables you to make 8 pictures 2¼x3¼ or 16 vest-pocket pictures. Uses No. 120 or 620 film. Has direct vision finder, waist level finder and handy trigger release on outside of camera.

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It's sure a dandy and so easy to use.
See you soon!
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EASY AND ECONOMICAL TO OPERATE

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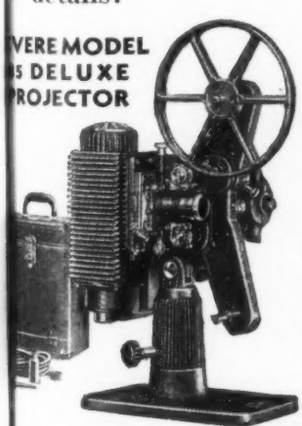

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Show Your Movies With a Revere 8mm. Projector!

Its 500 watt lamp, F 1.6 lens, duplex shuttle film movement, AC-DC motor, automatic film rewind (with enclosed gear and chain drive) and manual clutch for still projection give you brighter, steadier movies, better film protection, greater convenience and longer trouble-free service.

Two styles:—DeLuxe Model 85 (shown here) complete with lamp, lens and case **$75.00.** Standard Model 80, complete with lamp and lens **$65.00.**

EXTRA Wollensak lenses in focusing mountings for use on the Turret or the Model 88 are available, priced as follows:— F 1.9 lens **$42.50;** 1 inch F 2.7 telephoto **$37.50;** 1½ inch F 3.5 telephoto **$37.50.**

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Here is the camera that will give you, **at low cost,** the clearest and steadiest home movies you have ever seen. The Revere Model 88 with its **automatic film threading sprocket,** is simple to load and easy to operate. Eastman-type spool and spindle, **five** speeds, 8, 12, 16, 24 and 32 frames **per second;** built-in, parallax-corrected view finder; watch-like precision mechanism. COMPLETE with Wollensak F 3.5 lens **$32.50;** with F 2.5 lens **$44.50;** with Bausch & Lomb F 3 lens **$37.50.**

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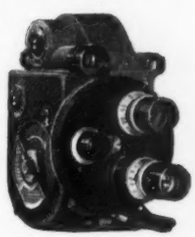
Has a revolving turret for 3 lenses and an extra optical view finder for use with telephoto lenses. Complete with one Wollensak 12.5 mm. F 2.5 lens **$65.00.**



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THE CHOICE *of men who can't afford to guess!*

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says Ivan Dmitri: "I find my G-E meter indispensable for COLOR shots."

says John Geisel: "I use my G-E exposure meter on all MARCH OF TIME shots."

says Daniel B. Clark: "Every cameraman at 20th CENTURY-FOX uses a G-E meter."

$21

READ WHY:

1. **Amazing accuracy.** The new G-E exposure meter gives you correct exposure every time. That's vitally important in good color work.
2. **Sharply directional.** It never cheats you of delicate shadow detail or rich color, because it won't pick up excess light from sand, sky, or water.
3. **One hand operates it—fast.** Finger-tip control, large, easy-to-read figures—all mean greater simplicity, greater speed.
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6. **Extra sturdy.** Because it's shock-proof-built all the way through, the new G-E stands up under accidental rough handling—a big asset to active photographers.
7. **Three meters in one**—a photo exposure meter, a darkroom instrument to make printing and enlarging easier, a meter to help you balance light better, especially for color shots.
8. **Always dependable.** Made to General Electric standards, it always reads the same, now and in the future. And it is so uniformly accurate that two or two hundred G-E meters give identical readings.

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"Designed for Better Pictures"

This interesting and helpful booklet tells the technical reasons back of the G-E meter's superior performance and dependability. It's free. Write General Electric, Schenectady, N. Y.

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GENERAL ELECTRIC

Why Wait? GET ALL YOUR PHOTO EQUIPMENT NOW!

AS LITTLE AS **$1 DOWN** AS LONG AS **A YEAR TO PAY**

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2¼x3¼ SPEED GRAPHIC

Small, compact, all purpose Camera for press, flash and all-around work. With American-made Kodak Ektar f/4.5 lens in supermatic shutter.

$117.50

Anniversary Speed Graphic, 3¼ x 4¼ or 4 x 5 with Ektar f/4.7 in Supermatic shutter $123.50
Kalart coupled range finder for any of above Speed Graphics, installed 27.00

National Graflex f/3.5 B. & L. Tessar. $ 87.50
Graflex Series B, 2¼ x 3¼, Revolving back, f/4.5 K. A. 91.00
Graflex Series D, 3¼ x 4¼, Revolving back, f/4.5 B. & L. Tessar..... 143.00
Kodak "Bantam," f/4.5 K. A. lens.... 22.50
Kodak "35," f/3.5 coupled range finder 47.50
Kodak "35," f/3.5 K. A. "special" lens 33.50
Kodak Monitor 620, f/4.5, K. A. in Supermatic shutter 42.50
Kodak Monitor 616, f/4.5 K.A. in Kodamatic shutter 35.00
Kodak Vigilant 620, f/4.5 K.A. in Kodamatic shutter 25.00
Ciro-Flex, twin lens reflex, f/3.5 taking lens f/3.2 viewing lens, 1/200 sec., 12 pictures 2¼ x 2¼ 42.50
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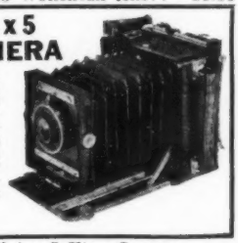
Argus C3, range finder, flash unit, f/3.5 33.50
Argus A3, f/4.0 lens focusing..... 16.50
Argus Color Camera, f/4.0 exp. meter.. 27.50
Agfa Speedex, twelve pictures 2¼ x 2¼ f/4.5, ½ to 1/250 sec..... 29.00
Perfex 55, with f/2.8 Wollensak lens.. 59.50
Perfex 55, range finder, 1 to 1/1250 F.P. shutter, f/3.5 Wollensak lens.. 44.50

B AND J 4x5 PRESS CAMERA



At last, a sturdy, low priced all round press camera. Has rising, falling, swinging and tilting adjustments, removable lens board. Ground glass back, auxiliary view finder, revolving back, less lens

$39.50

Graphic "All Metal" 4 x 5 View Camera with film holder and case less lens.. $89.00
Agfa Jr. Universal, 3¼ x 4¼ View-Camera with f/6.3 Wollensak lens in shutter and case 47.50
Watson 5 x 7 View Camera, 24" leather bellows, less lens 34.50

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Kodak Ektar, 5 in., f/4.5 in supermatic shutter, 1 sec. to 1/400 sec..... $44.50
Wollensak Velostigmat, 6½ in., f/4.5 in Alphax shutter, 1 sec. to 1/100 sec. 63.00
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Wollensak "wide angle," 3½" lens in Alphax shutter, covers plate up to 4x5. 31.50

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New Federal 219, tubular column, bellows, up to 2¼ x 3¼ f/6.3 lens.... $23.90
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New Eclipse 125, leather bellows, micrometer focusing, 2¼x3¼ f/6.3 lens 20.95
Eclipse 525, up to 2¼x3¼, f/6.3 lens 29.95
Elwood Model S2, 5x7, less lens..... 42.00
Kodak Precision, up to 2¼x3¼, less lens 67.50
Super Omega C, up to 3¼x4¼, less lens 134.50
D. A. "Versatile II," 3¼x3¼, less lens. 55.00
Solar Series II, up to 2¼x3¼, f/4.5 lens 49.50
New Solar Series IV, 3¼x4¼, f/6.3 lens 59.50

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Wollensak Velostigmats in barrel with iris diaphragm.
2" f/4.5..... $12.50 3½" f/4.5.... $16.50
3" f/4.5..... 15.00 5" f/4.5.... 25.00
B. & L. Enlarging Tessar, 4¾" f/4.5.. 30.00
B. & L. Enlarging Tessar, 3¾" f/4.5.. 26.50

EXPOSURE METERS

Weston "Master" No. 715—still, No. 720—cine $24.00
New GE Meter model DW-48..... 21.00
Photrix "SS" 18.75
DeJur Amsco "Critic" or **"Cine"**..... 16.50
G. M. Standard, model B..... 8.75
Brand New DeJur Amsco—5A meter with case. Reg. $12.50..... 11.25

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KODAK MAGAZINE "8"

Tops them all in performance! No threading, just slip in a magazine, close the cover and shoot. Four speeds, 16 to 64 f.p.s. Adjustable view finder. Wide range of lenses available.

With 13 mm f 1.9 lens..... $95.00

Perfex Cine Magazine 8, f/2.5 Velostigmat $59.50
Revere 88, f/3.0 B.&L. lens..... 37.50
Revere 88, f/1.9 Velostigmat lens..... 64.50
Revere Model 99, f/2.5 Velostigmat.... 65.00
Cine Kodak "K," f/1.9 lens..... 76.50
Keystone K-8, f/2.5 lens..... 35.00
Revere 80B, f/1.6 lens, 500 watt lamp.. 65.00
Revere "85," f/1.6 lens, 500 watts, Case 75.00
Keystone CC8, f/1.85 lens, 300 watt lamp 32.50
Keystone A-8, f/1.6 lens, 750 w. 400 ft. 74.50

FLASHGUNS

(Indicate camera and shutter when ordering)
Kalart Master Micromatic..... $14.95
Abbey Vimo Flash..... 13.75
Kodak Model "E"..... 16.50
Fink-Roselieve Flash 8.95
Mendelsohn speed gun, Universal model. 25.00

EQUIPMENT

Kodaslide Model I slide projector..... $18.50
Kodaslide Model II slide projector..... 33.50
Albert Foldex tripod, 55" extended.... 6.95
Albert Royal tripod—with pan head... 13.50
Trimetal tripod—with pan head..... 18.50
Albert automatic easel 10.75
Viceroy Enlarging Easel..... 5.50
Fedco double surface print dryer..... 6.95
Chess United range finder, "Chrome".. 5.50
F. R. range finder, "Chrome"..... 5.75
Kalart coupled range finder for plate pack camera 24.00
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40.01— 50.00	2.50	5.00
50.01— 65.00	3.00	6.00
65.01— 80.00	4.00	7.00
80.01— 100.00	6.00	8.00
100.01— 120.00	8.00	9.00
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I will pay $.....on delivery and $.....monthly.
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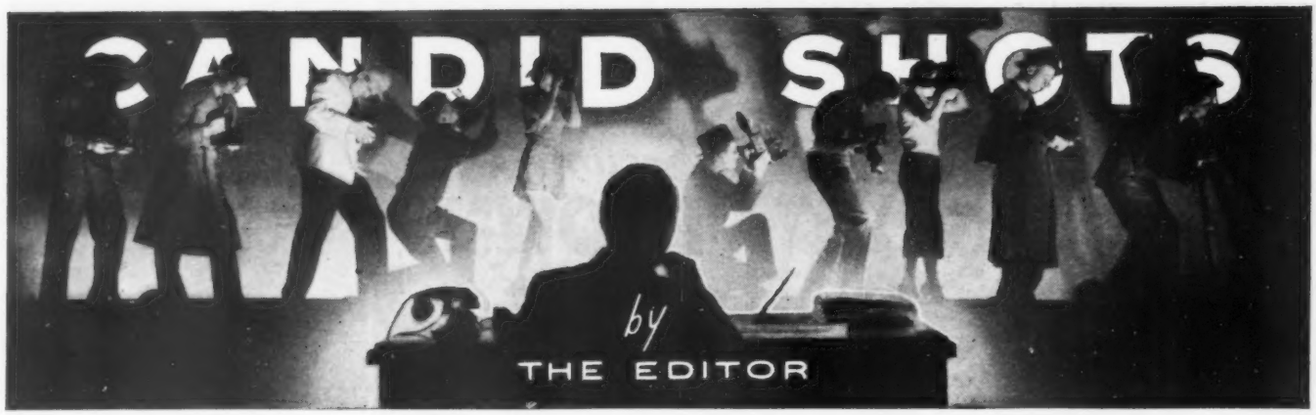


JUST one day after announcing the big 1941 POPULAR PHOTOGRAPHY Picture Contest, the first entry has reached our desk. Because it is a good idea not to put off mailing your entries until it may become too late, we want to congratulate Walter C. Grasel of Flushing, L. I. for his promptness.

The big contest machinery is in readiness to receive the thousands of pictures we expect and all arrangements are made for the careful and efficient handling of the prints and color transparencies that are so valuable to their makers.

Our announcement that the 1st Prize in Black-and-White would be a 1942 Packard Sedan has aroused considerable enthusiasm. We have been asked how it was possible for us to show the picture of a 1942 car at this time. The fact is that we could not show the 1942 car but had to substitute for it the picture of a 1941 Packard Clipper which lists at $1375. Our prize will be of a similar streamlined design—that's why we used the picture—but will not be identical with this car.

WE present to you in this issue Part I. of Herbert C. McKay's great book, *The Photographic Negative*. Written especially for us, it will be published in sections as an additional feature of POPULAR PHOTOGRAPHY.

It is for the first time in the history of magazine publishing that a magazine of our type presents its readers with a dividend of anywhere near this magnitude. The six Parts of this valuable text run in the neighborhood of 180,000 words. And just how large a book would 180,000 plus illustrations make? Well, for example there is one photographic handbook of approximately 100,000 words on the market selling for $4.00 and another of a little above 200,000 words for $6.50. This will give you an idea of the value received.

AMATEUR photographers in wartime Britain are up against all sorts of difficulties. Film and paper can be had only in limited quantities and there are even greater limitations on the subjects that may be photographed.

Naturally, all military and naval subjects are taboo. But what hurts the British amateurs most is that they are not allowed to photograph such effects of the war as bombed buildings and monuments.

There are sound military reasons for this and regulations are enforced strictly. Only recently a peer was sentenced to pay a high fine because he took pictures of bombed buildings for his own personal records.

YET the British amateurs are very active, regardless of all difficulties. Salons are held on schedule even though the visitors may have to duck into air raid shelters occasionally.

In this connection we want to call your attention to the forthcoming London Salon of Photography. Owing to misunderstandings there were practically no American entries in that Salon last year. Therefore, this year American exhibitors are urgently invited to submit their prints. For details see page 91 and the Calendar of Photographic Exhibitions.

An unusual one-man show was presented recently in an air raid shelter in London. The warden of that particular shelter happens to be a camera fan and he decorated the walls with his own prints. The exhibit was a great success and similar exhibits are now being recommended for other shelters.

Unmistakable warnings like this should be posted wherever picture taking is prohibited. Recently many unsuspecting amateurs were arrested for photographing seemingly harmless subjects.

UNIQUE among the activities of salons is the Print Analysis Service offered by the Springfield Salon. While the Amateur learns little or nothing from having his prints either turned down or accepted, he is bound to profit from an analysis of his pictures.

POPULAR PHOTOGRAPHY has offered a print criticism service since its inception but owing to limited space and other duties we can discuss only a few pictures each month. Because we realize that amateurs need helpful criticism to improve their results, we would greatly welcome it if other salons followed the example set by the Springfield Salon.

THE Library of Congress is trying to complete its file of POPULAR PHOTOGRAPHY but because we ourselves are completely out of certain issues we could not furnish all that are needed. The issues required are May, June, July, August, November and December, 1939. If any of you can spare a copy of these issues, send it to us so that we can help our National Library keep its files up to date. Or, if you prefer, you may write to us and we will send you one of the postage-free shipping labels furnished by the Library.

"IS Your Photography Improving?" How many of us could answer this question without reservations?

Yet anybody who is as engrossed in his hobby as the average amateur photographer and who spends as much time and money on it, should be able to answer without hesitation. That is why we especially welcomed this month's article by Dr. R. M. Relyea. He is himself an average amateur and he set out to find a method that would allow him to check on his progress in photography. Instead of simply assuming that he must have improved because of "experience," he wanted concrete proof. His suggestions are worth looking into.—*A. B. H.*

Filmo Auto Master

Filmo Auto Master, shown with normal, wide-angle, and telephoto lenses and their matching viewfinder objectives mounted on the turret head. With one lens, priced from $203.

. . . the only 16mm. camera with

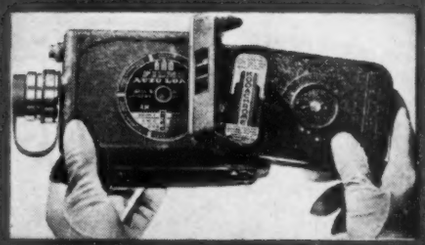
TURRET HEAD and MAGAZINE LOADING

● If you were to jot down the facilities your *ideal* movie camera should provide, you'd come mighty close to a description of Filmo Auto Master. For the features advanced amateurs requested were designed into this camera. It has a turret head that mounts three lenses *and* their matching finder objectives, for split-second readiness. Magazine loading that permits quick interchange of film even in mid-reel. A film chamber door that can be opened even when the camera is on a tripod. Five operating speeds including slow motion. Single-frame exposure control. Starting button lock. Enclosed, error-proof finder. *Complete,* built-in exposure guide for *both* color and black-and-white film. See it at your dealer's.

e three pictures illustrate one of the advantages of a turret head—readiness to take long shot, ium shot, and close-up in quick succession without moving from the most convenient position.

FILMO AUTO LOAD

Similar to Auto Master except that it has a single-lens head. Lens and its matching finder objective are quickly interchanged with special-purpose units. Choice of two speed ranges: 8 to 32 or 16 to 64 f.p.s. With 1-inch F 2.7 lens, $123.

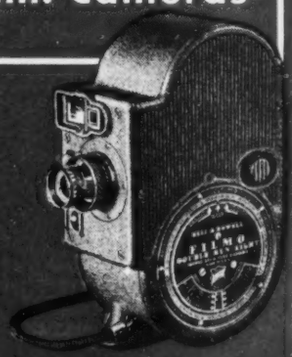


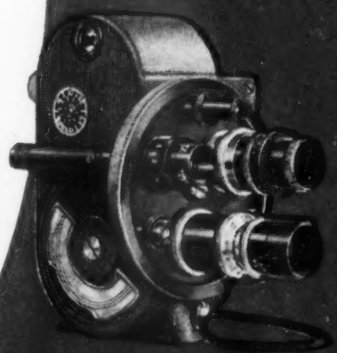
With either Filmo Auto Load (pictured) or Auto Master you can change from black-and-white to color film, or vice versa, even in mid-reel without fogging a single frame.

PRECISION-BUILT *Filmo* 8mm. Cameras

FILMO "COMPANION" 8

"Drop-in" loading—no sprockets. Four speeds plus single-frame exposures. Interchangeable F 3.5 lens. Finder masks for special lenses. *Lifetime guarantee!* Only $49.50.





FILMO TURRET 8

Mounts three lenses *and* matching finder objectives. Four speeds including slow motion. Single-frame exposure control. With one lens—F 2.5—now only $109.50. Or with critical focuser, as shown, $126.

Show TALKIES in Your Home

e you missed seeing some of the best u in the theaters? Would you like to g the world to your children, perhaps orrelation with their school studies? provide musical accompaniment[1] for silent films, or to lecture[2] with them ugh an amplifier and speaker? To e sound recordings[3] on disc records? ou can do all this, and more, with a osound. This 16mm. sound-on-film ector is as easy to use as your silent hine. And because it will do everyg your silent projector will do, can trade that projector in on a osound.

h Filmosound plus B&H Record Player
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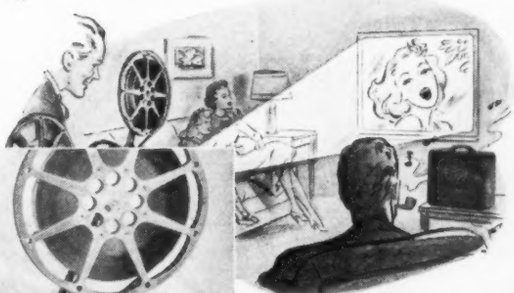
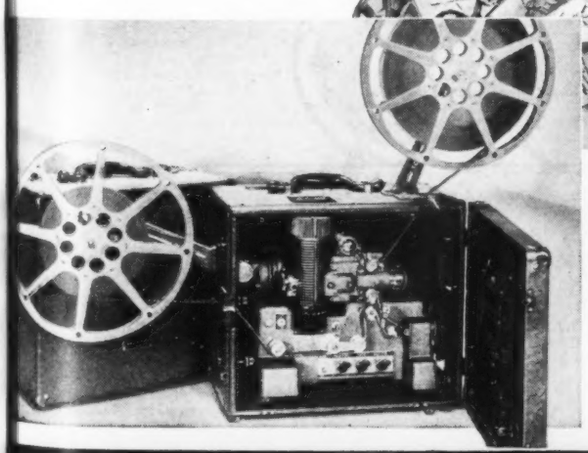
h Filmosound plus B&H Disc Recorder

Thousands of Films at Moderate Rentals

From B&H Filmosound Library you can rent fine sound film programs to suit any taste. Here you'll always find the *latest* 16mm. releases—B&H already has contracted for new films throughout 1942. Thus B&H makes it possible for you to entertain at home with such stars as Deanna Durbin in *First Love* and *Mad About Music,* Charlie McCarthy in *Letter of Introduction* and, with W. C. Fields, in *You Can't Cheat an Honest Man;* and such films as *East Side of Heaven, Rage of Paris,* and *Green Hell.*





This Filmosound costs no more than the finest Filmo Silent Projectors did, not many years ago. Ask your dealer to demonstrate it.

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PRECISION-MADE BY *Bell & Howell*

Questions & Answers

H. K., Brooklyn, N. Y. If you can spare the space, will you please publish a comparison chart covering the various systems of film speed rating? My exposure meter reads in DIN degrees, and I want to convert to domestic ratings.

ANSWER: A rather complete table for the comparison of film speed ratings appears in our May, 1941, Directory issue, on page 175.

L. B. L., Paducah, Ky. I plan to make some 35 mm positive transparencies in black-and-white, and want to know what type of film is best for this purpose. Can you advise me?

ANSWER: Several of the larger film manufacturers offer types of film designed especially for this purpose. These films are not difficult to use or process, and they produce excellent results. Write to one or more of the makers of film for details on this matter.

J.F.G., Washington, D.C. In addition to plastics and silicate glass, do you know of other general classes of materials being used to make photographic lenses at the present time?

ANSWER: First of all, plastic lenses are not being used for photographic purposes, not having been perfected sufficiently as yet. The Eastman Kodak Co., Rochester, N. Y., recently has been experimenting with a new type of glass lens in which no silicates are used. This lens is produced with the aid of tantalum, tungsten, and lanthanum, and is said to have a much higher refractive index than that hitherto available in optical materials. As yet it is not available to the trade, due to national defense requirements.

T.K.McC., Hartford, Conn. I have been experimenting with color printing by the Wash-Off Relief method, and it seems to me that my yellow printer is frequently rather flat in quality. Is this normal?

ANSWER: Your yellow printer is apt to appear flat, the blue contrasty, unless the corresponding values happened to be equal in the original subject. And such equality is comparatively rare.

F.McB., Philadelphia, Pa. Is there an enlarging paper made in sizes smaller than 5x7", and if so where can I obtain it?

ANSWER: From time to time we have noticed several kinds of enlarging paper in smaller sizes on dealers' shelves. If your local dealer cannot supply you from his stock, he will be glad to order it for you from any of the regular manufacturers. It generally must be ordered in lots of half a gross or more.

R.W., Lowell, Mass. I've been having trouble enlarging some rather dense negatives, some of which require a printing time of as much as 2 minutes. How about using an enlarging bulb of stronger wattage than my present one?

ANSWER: A lot depends on whether or not your enlarger is designed to take a stronger bulb properly. If you get too strong a bulb in the lamphouse there's considerable danger of overheating, with consequent damage to enlarger or negatives, or both. Two minutes certainly is an overly lengthy printing time, however, and a stronger bulb would help matters if it can be used safely. You might also reduce the negatives somewhat and use a faster paper emulsion if possible.

A.W.T., Cadillac, Mich. During a recent discussion, the question arose as to whether it is possible to photograph a mirage, such as encountered in desert country. One person said the answer was yes, since you can photograph anything the eye can see. Is this true?

ANSWER: Since a mirage such as you mention is basically nothing more nor less than a reflected image composed of light rays, it can be photographed. It's also true that anything which can be seen can be photographed. In extreme cases it may require special equipment, such as certain kinds of film or filters, to record everything the eye sees, but it can be done. Furthermore, the camera can "see" many things the naked eye cannot see, an example being infrared images recorded on film from great distances.

LETTERS TO THE EDITOR

Dear Sir:

Your attention is called to an error on page 141 of the May issue, where the Weston rating of Eastman Verichrome is stated as 50 Daylight and 32 Tungsten. This should be 24 Daylight and 16 Tungsten.

ARTHUR WOLF
Jamaica, N. Y.

● The figures 50 and 32 were correct at the time of publication and still are correct. It's wise to keep up to date on film speeds, as they are changed from time to time by the manufacturers. The Weston company keeps an accurate check on these speeds and publishes new ratings periodically. They are available from your photo dealer.—ED.

Dear Sir:

It looks like this cartoonist has used an idea from POPULAR PHOTOGRAPHY. The enclosed clipping of the cartoon is from my newspaper, and the photograph is from my April, '41, issue of your magazine. I suppose that they have to look all over in search of their ideas. It's nice to be the original that they follow—anyway it looks like the cartoonist had your photograph beside him at his desk. Note how even the faces of the spectators seem to bear the same expressions. The only changes are the introduction of the store window in the background and of the dog. . . .

Note the similarity between the cartoon and photograph

J. GARY MINKERT
Bryan, Texas

● Artists often turn to photographs for ideas, and it seems Cartoonist Frank Beck has used one of our prize-winning pictures. Harold W. Middlebrook of Gary, Ind., the photographer, should be flattered.—ED.

Dear Sir:

Please discontinue the remaining few months of my subscription, as owing to wartime regulations any subsequent issues will be confiscated by the customs authorities here. . . . Needless to say, I'm disappointed that I'll see no more of POPULAR PHOTOGRAPHY. . . .

As a last request, would you print my name? I'd like to hear from a few of your readers.

KEVIN W. HARRINGTON
106 Hampden Rd.
Hobart, Tasmania

● Readers are urged to drop Mr. Harrington a line. He's a dyed-in-the-wool enthusiast, and wants to keep up his photographic contacts, war or no war.—ED.

Dear Sir:

In your June issue, page 25, under the picture of the student nurses you say "It is a masterpiece of true candid photography." The book *Miniature Camera Work* tells how these nurses were instructed by Mr. Eisenstaedt on how to hold their arms, etc., before they went into the amphitheater. . . . Please clear me up on the photographic meaning of the term "candid."

GLORIA J. FRANK

● The word "candid" can mean either a picture which is snapped without the subject's knowledge or one which is carefully planned to make it appear spontaneous and unposed. Some of the best candid pictures that are taken are really rehearsed over and over again before the shutter is clicked.—ED.

Dear Sir:

Your photos of Yellowstone, in the June issue, recalled a happy vacation combined with a sad photographic story. I visited there last summer. The spray from Old Faithful and other geysers stained 3 of my

Leica lenses, and I had to spend $9 getting them repolished. I'd advise photographers in Yellowstone to keep filters on their cameras at all times (which I did) and to avoid changing lenses near the geysers (which I *didn't*). . . .

WILLIAM ISAACS
New York City.

● Thanks for the tip. This is the first time we've heard this about the spray thrown up by geysers, and we are glad to pass the warning along to other readers.—ED.

Dear Sir:

I would like to ask a question about some of the marvelous pictures appearing in your May issue. Why did so many of the photographers seem to preoccupy themselves with using small lens stops? In *Buck Fever* and *Pillow Fight* the aperture was *f* 32, in *The Old Gray Mare* it was *f* 11, and in *Home Town News* and *Fishing* it was *f* 18. I'm familiar with the depth-of-the-field laws, but surely all of these shots didn't require such abundance of depth. . . .

CAIO A. BOTELHO
Sao Paulo, Brazil.

● It happens that you picked out a bunch of flash pictures in this instance, and the photographers had to stop down because of the brilliance of the flash illumination. You won't find any great preponderance of small apertures in the data for our usual collections of prints in the Salon Section or Pictures From Our Readers.—ED.

Picture of the Month (opposite page)

YOUNG NAVIGATORS.....by Elise Voysey

The best pictures of children show them absorbed in play. The photographer paved the way for this fine summer shot by giving her young models two toy boats. When they waded out to sail them, she snapped this unposed picture. [For Technical Data see page 90]

YOUNG NAVIGATORS

By ELISE VOYSEY

GIANT CAMERA

Tower camera designed and built by Lockheed for photographing loft drawings. J. H. Washburn, photo department head, is about to expose a 14x17 plate.

In a room which serves as the "bellows" of a huge camera-projector, template cameramen check a drawing which is projected onto the sensitized metal sheet.

by Alex Evelove

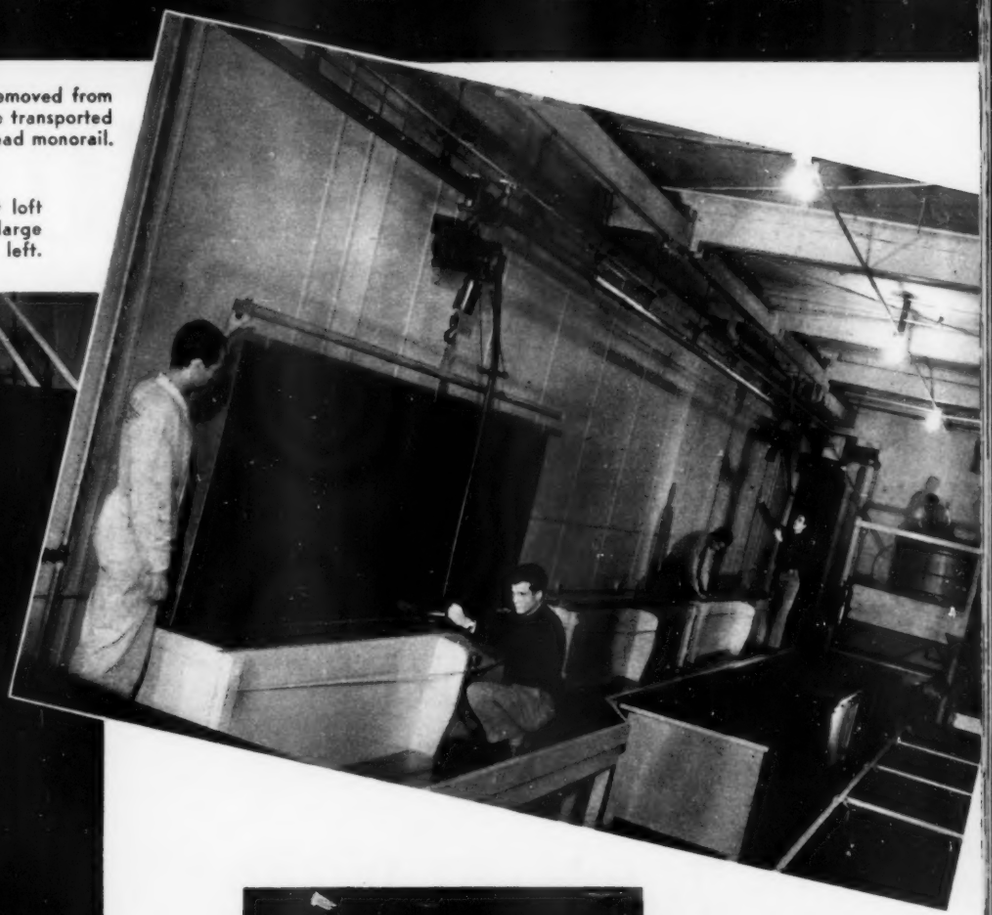
Photography plays an important part in speeding up aircraft production in the present national emergency. Specially designed equipment and new methods help to eliminate time lag and labor waste.

PHOTOGRAPHY is doing a major job in defense industries today. It is breaking the bottlenecks—dread enemies of production—particularly in the aviation industry now serving this nation and Great Britain.

The camera is making the factory co-ordinator's job an easier one by helping to dissipate the time lag and labor waste which once plagued the various departments of plane building. No longer does one division of an aircraft factory wait weeks, even months, before it begins its own special job on a new model.

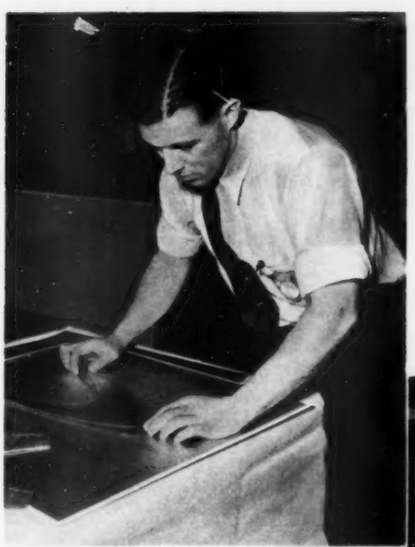
Today the camera makes it possible for all departments to begin participation in the building of a new model while it is being conceived on the drafting boards. Actual and accurate scale models are being cut out of special metal photographic plates. Parts can be boomed through to the foundry for fabrication without delay. Experimental work time is cut immeasurably. Innumerable man hours are conserved for other purposes.

A SPEEDS DEFENSE



Here a 4'x12' metal sheet is being removed from hypo tank. After exposure, sheets are transported to processing laboratory on an overhead monorail.

Template negative which was made in the giant loft camera is being set up for projection onto the large metal sheet shown in the illustration to the left.



After the metal sheet is developed, the template is cut out and very carefully checked for size against master photo template.

And new planes zoom into their test flights as much as two to four months sooner than they would have under the former system.

At the Lockheed Aircraft Corporation, one of the largest airplane producers in the country, J. H. Washburn heads the photographic department which has grown from an adhesive-taped, plyboard darkroom to a vital, salient department of plane production. Since 1934, when this one-time amateur photographer made his own job at Lockheed and bound the plyboards together with stickum, the use of photography there has developed to the point where the camera has become a regular tool of manufacturing procedure.

Washburn's joint interest in aviation and photography led eventually to the present Lockheed system of bottleneck-breaking and the present extensive photo department in its Burbank plant. The basic idea stemmed from a number of places. The motivating agent was someone's question about the possibility of making photographic templates, or patterns and guides, for the later mechanical work in the factory. The question was asked several years ago, before time became the essence of plane production. The aviation industry had no pressing need for a new method then; but investigations were under way, at the Glenn Martin plant in Baltimore and elsewhere, which were to prove invaluable later when the necessity made itself felt. (*Continued on page* 98)

Final step in production of a part comes when the shop template man checks the finished part against master photo template.

FAKE PICTURES in

By ROBERT W. BROWN

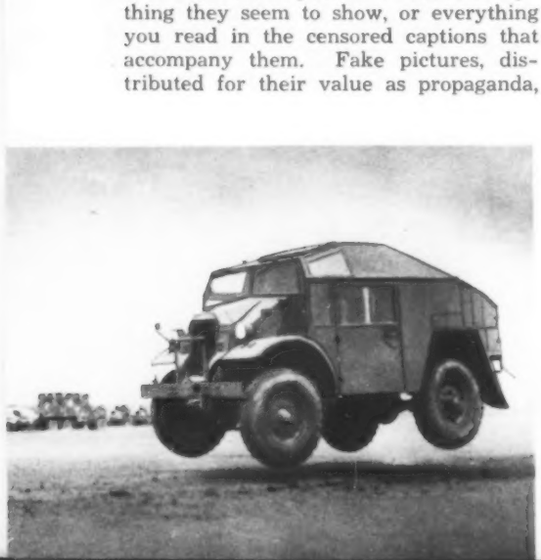
This shot of a flame-thrower in action was taken at a Nazi training school. It was released as a real attack on the Maginot line.

You can't believe everything you see in war pictures. Propaganda agencies release many bogus shots.

PICTURES are doing a big part of the job of telling the news of World War II. You see them in your daily paper—photographs showing troops in action, new weapons in use, and evidence of destruction. But you can't believe everything they seem to show, or everything you read in the censored captions that accompany them. Fake pictures, distributed for their value as propaganda, are becoming more and more common every day.

The use of fake pictures in the current war appears to have started in June, 1940, when German censors released to *International News Photos* a picture showing three giant howitzers ready for action. The caption stated, "On the Western Front—Three giant Nazi howitzers are set to 'speak to the allies'. . . ."

The picture was convincing enough, and the caption seemed plausible—but a keen-eyed editor recognized the photograph as one which had been released by the German Propaganda Ministry and printed in the August 28, 1939, issue of *Life*. At that time it was captioned as a picture of Nazi artillery ready for action on the Polish border, before the war.



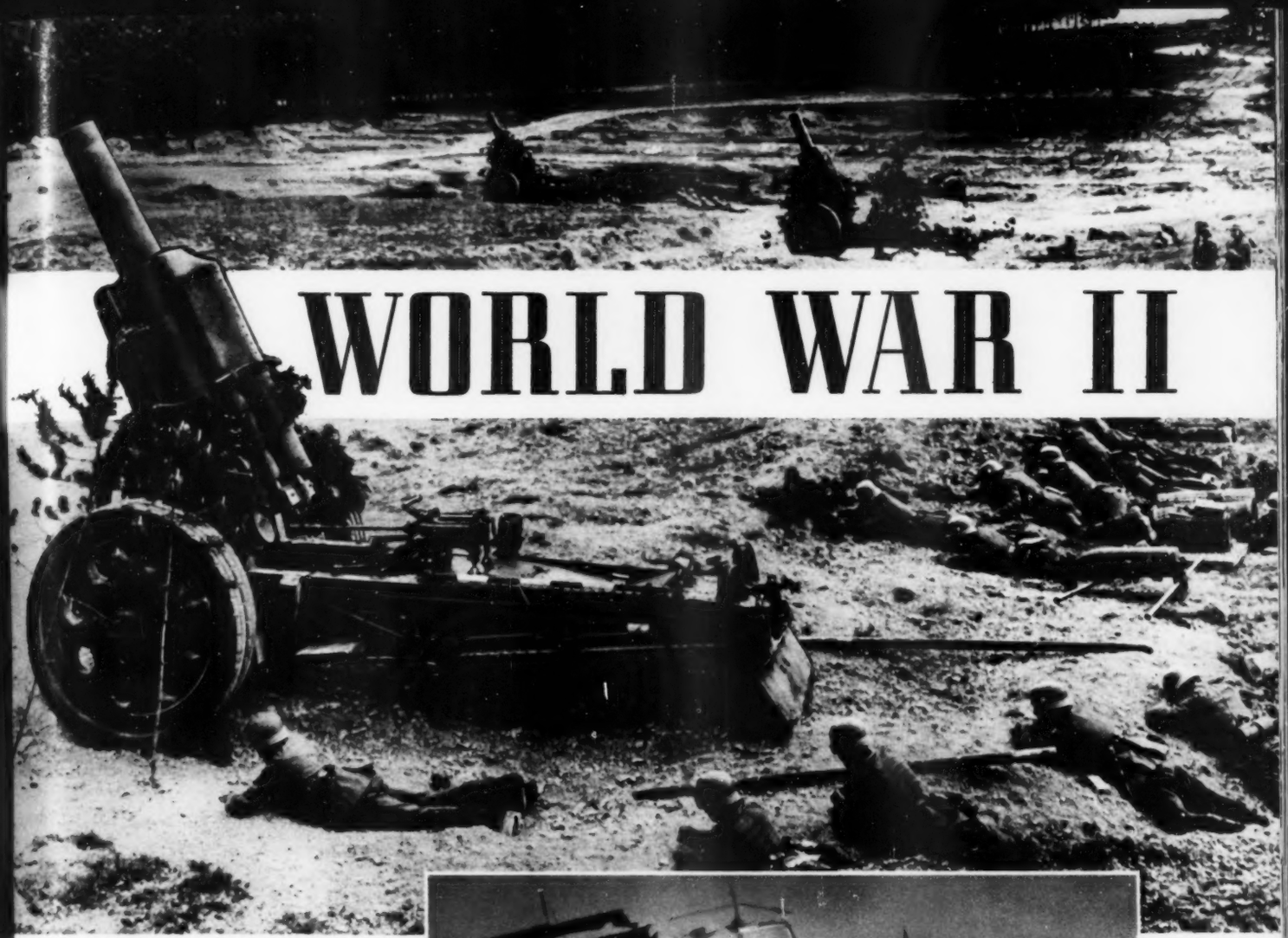
The British released this picture twice—first as a gun tractor test in Canada, and later as a field workout in North Africa.

Since that fake was exposed, editors have become increasingly wary of pictures released by the Nazi Propaganda Ministry. Their findings have led them to believe that Germany is releasing a flood of propaganda pictures, for the purpose of keeping the Nazi army constantly in the news in the most favorable light. Pictures which originally served another purpose, one, two, or even twenty years ago, are reappearing labeled as authentic photographs of the war today.

It is difficult to check back and trace down all of the pictures which are questioned by editors. Where photographs have been published before, like the shot of the howitzers, it is relatively simple to prove they are fakes. But many others may slip through without detection by picture editors.

Another clear-cut attempt at deception was exposed last February by the New York *Herald Tribune*. The German war film, "Victory in the West," had its premiere in Berlin. A flood of "stills" from the picture were distributed to newspapermen by Dr. Paul Joseph Goebbels, Minister of Propaganda, who said, "This picture illustrates the almost unbelievable precision and bravery of our troops in action against the Maginot Line and Belgian forts."

WORLD WAR II



Originally labeled a picture of German howitzers on the Polish border, this shot was released later as from the Western Front.

The pictures he passed out were sent by Clipper to the picture services in this country, and soon a flood of duplicates were on their way to the newspapers of the nation. Among them was a set addressed to the desk of Dick Crandell, roto editor of the *Herald Tribune*.

He leafed through them with interest, and then saw something that stopped him. He called Harry Casler, daily picture editor, and together they inspected a shot showing a flame-thrower in action.

"Ever seen this one before?" he asked.

"Sure," Casler replied. "I could recognize that one in my sleep. We used it about a year ago. What's so hot about it now?"

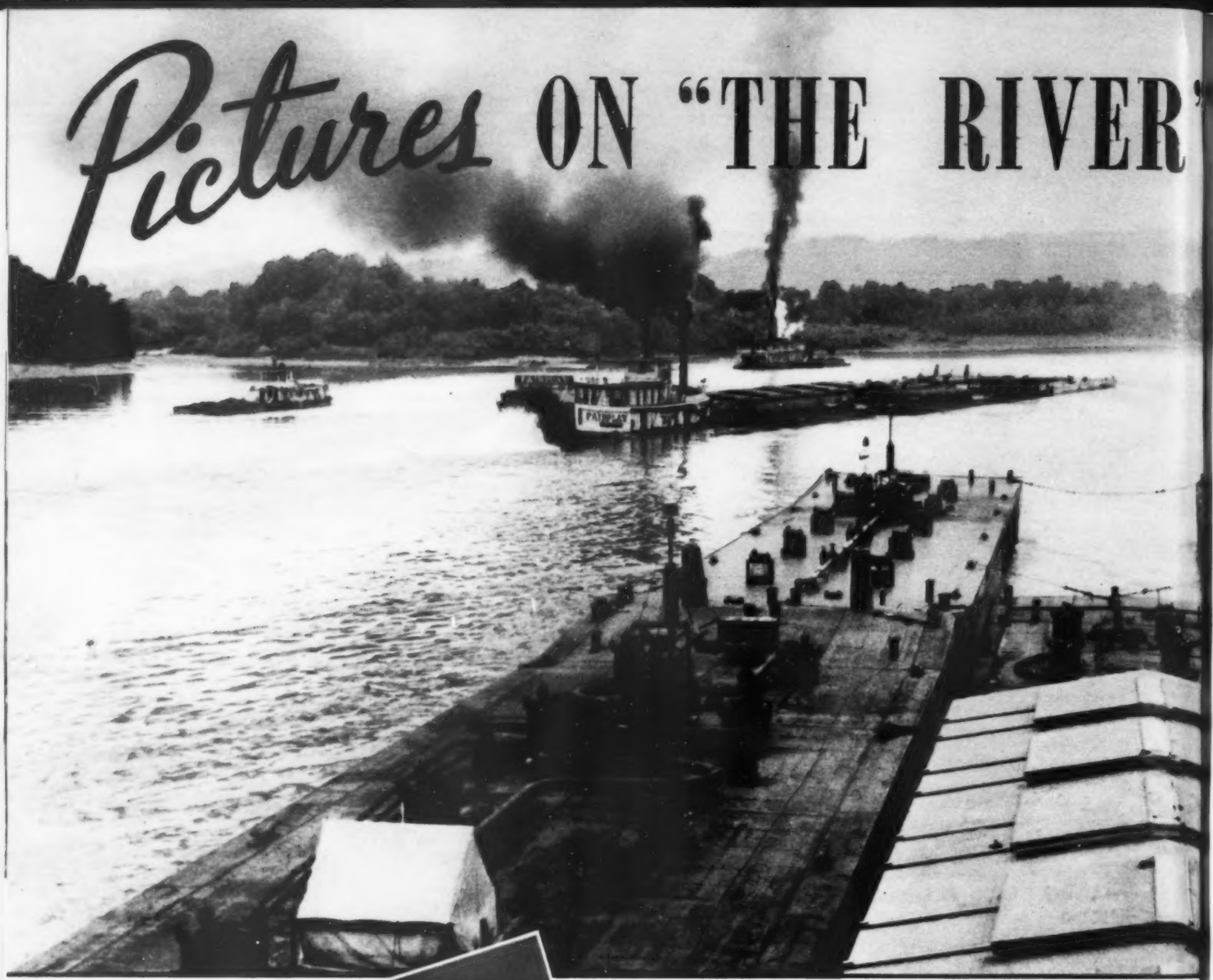
"We used it then as an illustration of tests being made in a training school. Now the German Propaganda Ministry has just released it again as part of an assault on the Maginot Line. It's nothing but a fake."

So the news broke across the country. *Acme* Newspictures rushed out a "kill" order to its editors. That Sunday the

(*Continued on page* 102)

A cautious editor recognized these photos, released as fresh news by German censors. Actually, they were made in World War I.

Pictures ON "THE RIVER"



Old-time steamboats and modern, diesel-powered craft churn the river side by side.

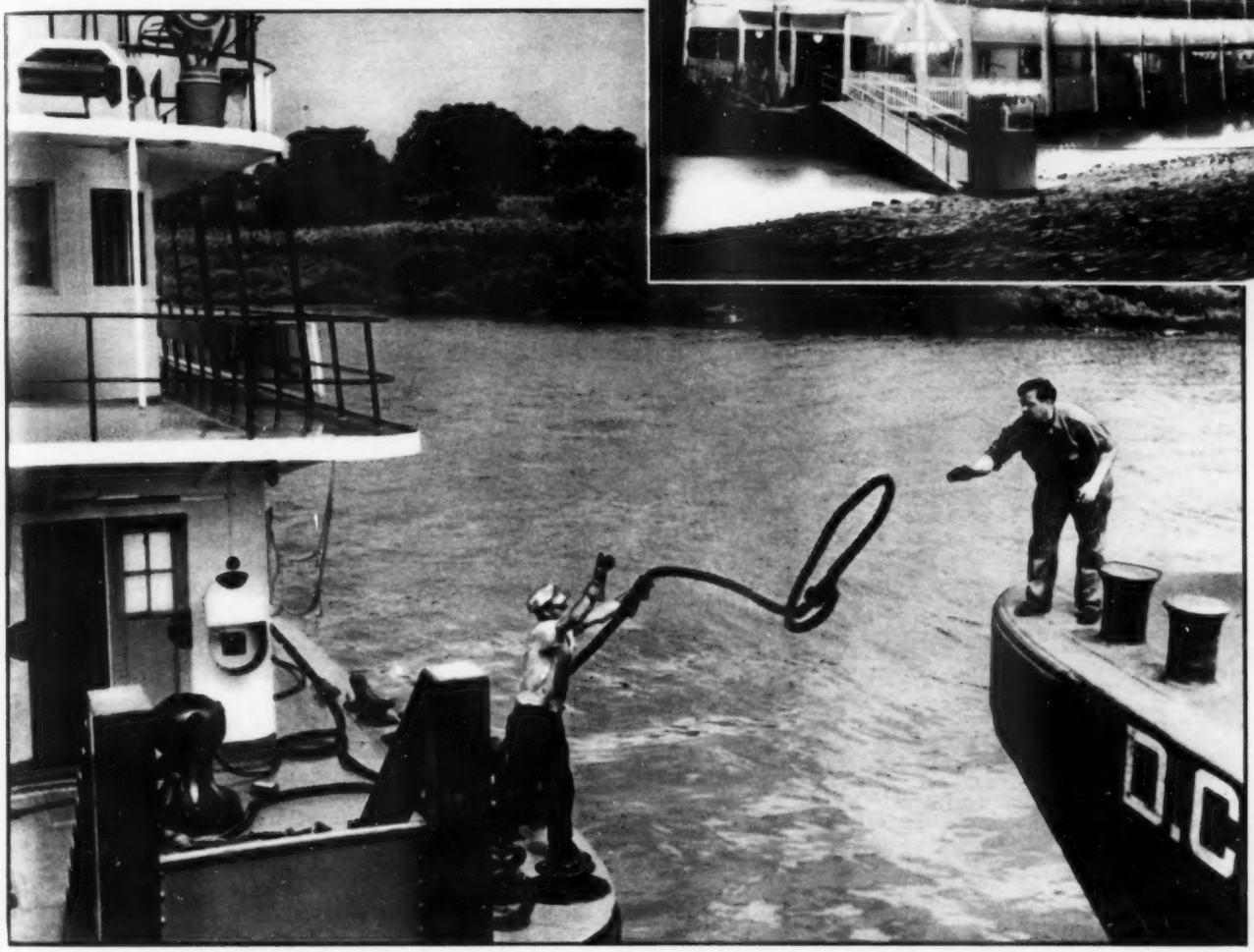
by **CAROLYN RAMSEY**
Assistant Editor, Photography Division,
National Educational Alliance

Ol' Man River provides a wealth of fine photographic material. Here's what to look for on the Mississippi.

If you take pictures from the deck of a boat, watch for opportunities to use its rigging to get foreground framing.

Catch colorful rivermen in typical poses. They say the best pilot is the one who can get his feet the highest.

You can get lots of good river pictures without stepping off dry land. At night you can take time exposures of excursion boats like the "Idlewild" (right), tied up at the shore, their decks ablaze with light. For good action, show deckmen as they throw the heavy towlines used to make the barges fast.



FOR glamor and color, for old romantic nostalgias and zestful, streamlined modernism—take your camera to the Mississippi!

There is scarcely another subject in the country which offers as rich a variety of material for photographers. There is romance and glamor yet to be pictured—in the sternwheelers which still push their weary way up the mighty stream, in the personalities of the zestful old pilots and the shiftless shantyboat men, and in the few packets which still live the legend of the ancient packet palaces. But there is streamlined modernism here, too. Diesel-powered towboats pushing great fleets of barges, modern dams and locks which are engineering triumphs, steel bridges flung defiantly across the surly waters—these are a few of the river's modern aspects.

And always, of course, there is the Ol' Man himself, sprawling broad and insolent under the hot afternoon sun, or growing misty and mysterious in the dusky twilight. Yes, Ol' Man River makes as fascinating a study for the camera as he ever did for that magic-tongued dud of a pilot, Sam Clemens, who later wrote as Mark Twain!

Boats, as any riverman will tell you, are the best things about the river. And there are things a photographer must know about traffic on the river if he is interested in catching the whole picture.

The Mississippi of song and story carries five times as much traffic today as it did in the heyday of "steamboatin' on the river." The kinds of boats a photographer has to choose from are myriad. More than 4,000 vessels ply the river.

Towboats are streamlined and diesel-engined, or they are big, old-time sternwheelers. There are long fleets of coal, iron, and gravel barges pushed by towboats. There are government dredge boats, and snaggers and sandsuckers. A gasoline boat shoves along a load of empty barges. Huckster steamboats churn the river on their short runs. Speedboats and fishing boats go by. Lazy shantyboats drift into the mouths of the smaller rivers. The *Chris Greene*, once an old packet, chugs along with a load of automobiles. The *Valley Belle* pushes a humble gravel tow, perhaps reminiscing over the days when she propelled *Bryant's Showboat*. The *Golden Eagle* passes with gayety and laughter, a lone reminder of the proud packets which once crowded these waters. Each of them is a subject with a different meaning for the photographer who knows the river.

Getting good pictures of these boats is

(*Continued on page* 80)

Some of the best subjects on the river are the roustabouts who load the steamboats. You can snap them on the levees.

Roughing It with the CAMERA

By
LOUIS HOCHMAN

Nature provides materials for many accessories you can build on photo hikes instead of carrying them.

Three forked sticks and a length of cord were used for this tilt-top camera support. A knife was the only tool required.

YOU don't have to carry all your equipment along when you hike deep into the woods for nature pictures. Many handy camera accessories are yours for the making, as long as there are trees or bushes to be found. You can improvise lots of devices as you need them, and then leave them behind when you move on.

A tripod is a mighty important piece of equipment, but there are times when you may not want to carry one. Its weight and bulk are not welcome on a long hike, far from paved sidewalks. If you go out without a tripod and then find you need one, you can make it on the spot.

Just pull out your jack-knife and cut down three long, straight branches with forked ends. These can be propped together to form a tripod, the forked ends interlocking in a tight grip. Tie them together near the top, set your camera between the forks, and then tie it in place. The feet of this tripod should be sharpened to points, which can be pushed into the ground. To add greater rigidity, the tripod can be anchored with a length of rope, tied to a stake driven into the ground beneath it.

A makeshift tripod of this sort can be made so simply and quickly in the woods that there is no reason for burdening yourself with a ready-made model on long hikes. It can be discarded when you are through taking pictures in one location, and replaced by a new one when you come to another place where you need it.

Camera supports are the most plentiful of nature's accessories. A small tree with a fork in it, the branch of a large tree, a flat rock—many things can be adapted to photographic uses when required. However, you should keep on hand a short length of rope, a roll of stout fishing twine, a package of matches, and, of course, a jack-knife. With these few supplies you can apply your skill and ingenuity in the field of photographic woodcraft.

Another accessory which may be needed once in a while is a tilting-top camera support. This may sound like a big order, but in reality it is quite simple.

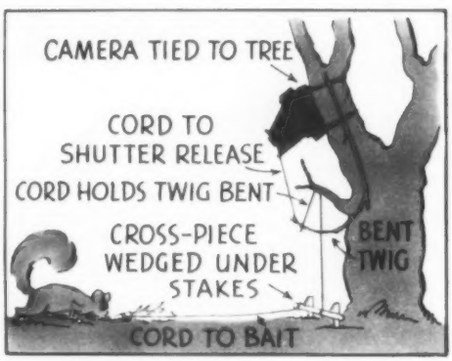
First, find a straight, heavy branch, about 5 ft. long, with a forked end. To this, fitted into the fork, tie another slingshot type branch with a long handle to serve as the tilt top. A third, shorter forked branch is tied by its fork to the end of the second one's handle and serves as a sliding bracket for the tilt-top. This branch is then brought back to the main branch and tied to it with a slipknot about 8 in. below the top. If there is a fork in the main branch at that point, the sliding bracket branch can be passed through it, and tightening can be accomplished by pulling the fork together with a loop of rope. The camera is tied to the fork of the tilt-top branch, and adjusted to the proper angle by raising or lowering the handle and tightening the sliding bracket branch at the main support.

In many cases, the camera can be wedged securely into the crotch of a small tree by spreading the fork carefully and letting it come together on the camera. It should be protected by cushioning with a couple of handkerchiefs.

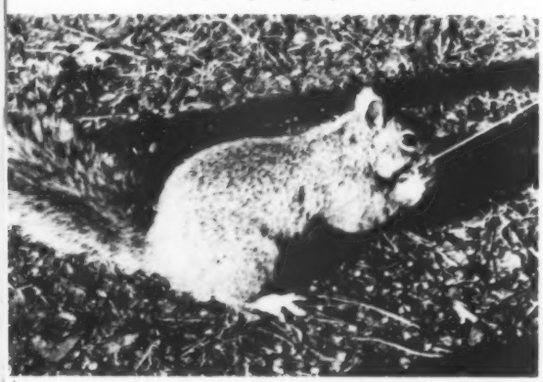
Probably, in your wandering, you will come across scenes in which you would like to pose yourself. This calls for a delayed-action shutter release. Again you look to nature for a solution, and she responds with the materials necessary to make a serviceable self-timer. Here is her formula.

Secure the camera to a solid support—

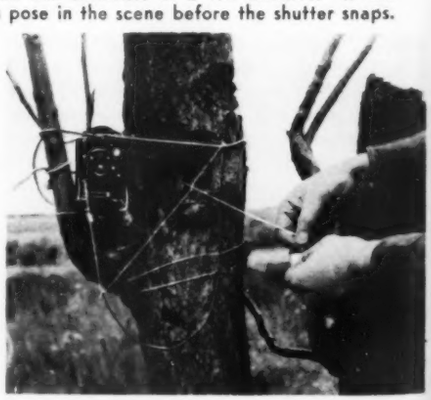
(*Continued on page* 85)



A photo trap for taking pictures of small animals can be rigged up by following the sketch above. The author used this sort of setup to photograph the squirrel below.

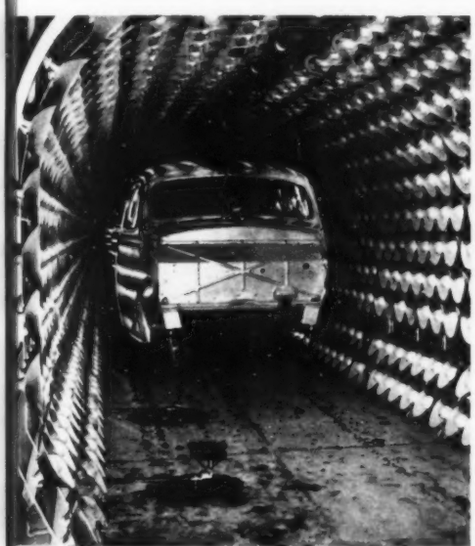


Here is a delayed-action shutter release you can assemble in a few minutes. It will enable you to get your camera set and then pose in the scene before the shutter snaps.



Keep your lighting well balanced for pictures in which there are many different colors that you want to render accurately on film.

Right: Extremely accurate synchronization is essential for taking color pictures showing action, like this café scene.



Added illumination had to be balanced with the heat lamps to show this paint dryer in action.

This picture required more light than expected, for a high ceiling provided little reflection.

COVERING *America in Color*

by Konstantin J. Kostich, Ph. D.

The rules don't cover half the setups you're bound to find shooting color. Here's how tough problems were solved in taking pictures all over the country.

GETTING good color pictures is easy, if you observe a few simple rules. Try first for closeups, rather than unwieldy long shots. Watch line and composition, and don't get a mass of conflicting colors in a single picture. Shoot color only between nine and eleven in the morning and between one and three in the afternoon.

If you follow this advice, your color is bound to be good—but, the trouble is, you won't follow it. Sometimes you will want to take pictures just before sunset, or at high noon. Many of your picture setups are likely to contain conflicting colors, and you won't be able to eliminate everything which doesn't harmonize perfectly with the rest of the scene. Broad, general rules are made to be broken, and there are ways of getting good pictures even when conditions are not the best.

I found that out time and again during the past year and a half, which I've spent covering America in color for a prominent American publishing house. I covered the 48 states, Hawaii, and Alaska, filming everything from the giant machines of the automobile factories to the tiny flowers of the desert.

Schedules often forced me to work in the late afternoon, when the sun covered the landscape with shades of orange. Quite often Kodachrome A, designed for use in artificial light, proved suitable under these conditions. Sometimes it was necessary to shoot on cloudy days, and filters were used to cut the excessive blues and give warmth to the picture.

So it is in any discussion of color pho-

(*Continued on page* 105)

SIMPLE TECHNIQUE for BEACH PICTURES

Guard stand adds beach atmosphere to this fine angle shot.

By **Duke**

Lifeguard—Photographer
Santa Catalina Island, Calif.

An expert at beach photography gives his rules for posing, backgrounds, use of filters, and exposure

I'VE been on the beach all my life. Not because I have no job nor an incentive in life, but because being on the beach *is* my job. Saving lives is my vocation—but my avocation is photography.

People ask me questions about the latest approved method of artificial respiration, or how one drags in a corpulent swimmer from beyond his depth. But most of the inquiries directed to me atop the lifeguard stand on the beach at Catalina have to do with photography. "What lens stop should I use?" "What filter will give best results?" "What exposure would you use?" I've come to be a filmsaver as well as a lifesaver!

In the past four years I've made more than 15,000 pictures—most of them on the beach where I spend all of my time—and I've photographed everything from a lone wave to a crowded shore, movie actors and other celebrities, and just plain Jane and John Doe having a swell time. Perhaps it is because of this wide experi-

Good composition marks this surfboard picture made with a red filter.

Portrait taken with light green filter gives good rendition of skin and darkens the sky.

Fast film and fast shutter speeds are needed to stop action of the youngsters at play.

Right: Railing permits a natural pose and gives subject something to do with her hands.

Below: The author stopped movement in this action picture of Peggy Moran at 1/100 sec.

ence, or because of the photographs which adorn my lookout, or the fact that many of my pictures have won recognition in salons and contents, that my lifeguard stand on the beach at Santa Catalina has become the headquarters for the ever-increasing clan of camera fans.

Shooting pictures on the beach offers unlimited opportunities for good photographs, once you overcome the particular problems that are encountered and which are not to be found in other fields of photography. There are unusual conditions of light and shadow, problems of composition, background, and exposure to be considered. So a few simple rules of procedure are in order. If they would be observed by all camera fans, there would be a saving of the hundreds of thousands of negatives made at the beach which, due either to lack of general interest or technical failure, are never even worth printing.

As to equipment, the camera itself is not of primary importance. An expensive camera may enable you to increase the range of your photography in getting pictures which are impossible with an outfit not equipped with numerous accessories and gadgets. But any ordinary camera, properly used, will give you pictures which can be just as interesting and that may win just as many prizes.

A lens shade is practically a necessity in beach photography due to the many reflections of light from the water, sand, and other objects, which might cause halation.

Filters are recommended to provide

(*Continued on page* 96)

Fine landscapes like this are easy to get, once you are out in the country. Slip a filter over your lens to bring out clouds.

FOCUS ON THE FARM

by
HAZEL
B. GIRARD
Photographs by J. W. McManigal, Horton, Kansas

The farmer himself is a fine photo subject. Don't let him dress up—show him in his working clothes for a photograph that is true to life.

The crowded dinner table at threshing time is a typical farm subject you won't want to miss. Flash was used to get this picture.

There is good human interest material in farm children and their pets. Photograph them in closeups that seem natural and unposed.

Take your camera to the country, where clean air, blue skies, and a wealth of subject matter make it lots of fun to snap pictures.

WHETHER you have lived in the country or have been a city-dweller all your life, you can get fine pictures on the farm. There is plenty of landscape material. There are wide open spaces, with a wealth of light under the blue sky. There is work being done—work with a purpose, which is interesting to watch and to see in pictures.

Who could possibly be more photogenic than those ruddy-faced, sinewy-handed workers on the productive end of all foodstuff? Here is food in the raw—work that is work—and tireless, unafraid men whose labors are not affected by wage-hour laws. Just plain American farmers, no less, with more lens appeal than you could shake a tripod at!

Farmers are friendly, helpful, and courteous. They are pleased that others find their work interesting enough to photograph, and will go to added effort to be of assistance. Don't forget to reciprocate their kindness. Always shut gates behind you, don't climb fences, and it's wise not to smoke on their premises.

No one knows better how long a day's work is than do these men, so most of them relish a chance to rest on the plow handles awhile and pass the time of day. But a farmer's time is his most valuable asset and must not be infringed upon unduly. The yellow wheat gets yellower, and the tax deadline is no respector of persons.

Last summer I ran the gamut of conversation from A to Z—watchdogs and potato blights, gardens and farm electricity, county fairs and the best way to "break up" a setting hen, hot weather and cold-packing, lumberjack days and the passing of the old gray mare.

A farmer is pleased as Punch to have his efforts appreciated. If he owns a neat-looking farm, he likes to be told about it. If he's driving a sprightly team that is right "up on the bit," sleek, and well-fed, he'll think you're pinch-hitting for Gabriel himself if you take time to tell him he's a good chooser of horse

(*Continued on page* 111)

The long furrows of a plowed field make interesting patterns in landscapes. Late afternoon shadows will make them stand out.

There are many opportunities to get action in pictures on the farm at threshing time.

"Mahomet's Mountains"
". . . and so, when the mountain did not come to Mahomet, Mahomet went to the mountain."
NATIONAL PARK SERVICE
GLACIER
NATIONAL PARK
TWO MEDICINE ENTRANCE
DEPARTMENT OF THE INTERIOR
In lakes and streams fed by milky glaciers big trout were lurking.

Illustrations are from the author's color film "Mahomet's Mountains." They were enlarged from 16 mm frames.

Filming

A VEST-POCKET TRAVELOG

By

ORMAL I. SPRUNGMAN

Film that summer trip, even if you have to conserve on footage. A good travel movie can be made by shooting high-spots and editing later for smooth continuity.

MAYBE you're the sort of movie maker who dons seven-league boots when you travel—who likes to see country and see it fast, without stopping to putter in too many places. Naturally, if you take your movie making seriously, results are bound to suffer, for any experienced travelog filmer will tell you that well-planned travel movies just can't be hurried.

But if you travel much and film little but *well*, you can whip together a vest-pocket travelog that will compare very favorably with the professional thing. And it makes little difference whether you head for the Southlands, go jaunting through the New England States, or trek over the Pacific Northwest. Once you decide on your destination, make a list of points of interest, highlighting these in your film. Then arrange your schedule so that you'll hit these places when the light is right, even planning for lay-overs to wait for good weather.

Suppose you're a Chicagoan, California-bound. Enroute are Mark Twain's cave and Tom Sawyer's white fence at Hannibal, Missouri. Oklahoma's forest of oil well towers are worth recording, and your first glimpse of cotton pickers in the fields will offer a ciné thrill. The picturesque city of Santa Fe, with its adobe houses, will make interesting Kodachrome footage. Then there are Grand Canyon, Boulder Dam, Death Valley, Sequoia, and Yosemite, too.

Perhaps you shoot 20 feet here, 50 feet there, each shot well-exposed and neatly framed. Some of the scenics contain fluffy clouds, while others have human interest with a touch of wildlife here and there. None of these separate sequences would make a feature in itself, yet by combining all of them under some such title as "Southward to Summer-Lands," your continuity begins to take form. You can fill up the gaps with special shots taken at home, showing a pencil tracing the route on a road map, or a

(*Continued on page* 94)

Practical Infrared For The Amateur

Realistic moonlight effects can be obtained easily with infrared film. This beach picture was taken in bright daylight.

By
TED HUGGINS
Amateur Photographer, San Francisco, Calif.

Anyone can take striking pictures like these with an ordinary camera, filter, and infrared-sensitive film.

YOU don't have to be an expert to take striking and unusual pictures like the ones shown here. Neither will you need special or costly equipment; the camera you now have will do the job. Simply load it with infrared film, place an orange or red filter over the lens, and you're all set to get some of the most interesting pictures you've ever taken.

No longer is infrared photography shrouded in a cloak of mystery, nor an exclusive medium for the technician and scientific worker. With the introduction of infrared-sensitive roll and sheet film in all popular sizes, the amateur photographer now has access to this fascinating field. Your dealer probably stocks the film or can get it for you on reasonably short notice, and the cost is only a few cents more than you have been paying for your regular black-and-white films.

The actual picture taking with infrared is simple. One point, however, should be made clear at the outset, and that is in regard to the use of your exposure meter. You *don't* use it! The reason may be obvious to many, but the essential fact becomes clear once you understand the nature of infrared rays. To begin with, "infrared" means "beyond the red." In

Cloud formations are rendered in great detail in infrared pictures; whites appear bright, but the shadows lack detail.

Darkened water contrasts with white foam.

Death Valley, Calif., photographed by infrared. Note road, left, and details in distance.

other words, infrared radiation lies beyond the red end of the visible spectrum and is *invisible*. Now, your exposure meter is sensitive only to the wavelengths embraced by the *visible* spectrum. Naturally, then, one cannot get a reading with a photoelectric meter, and of course you could not use an extinction-type meter to read invisible "light!"

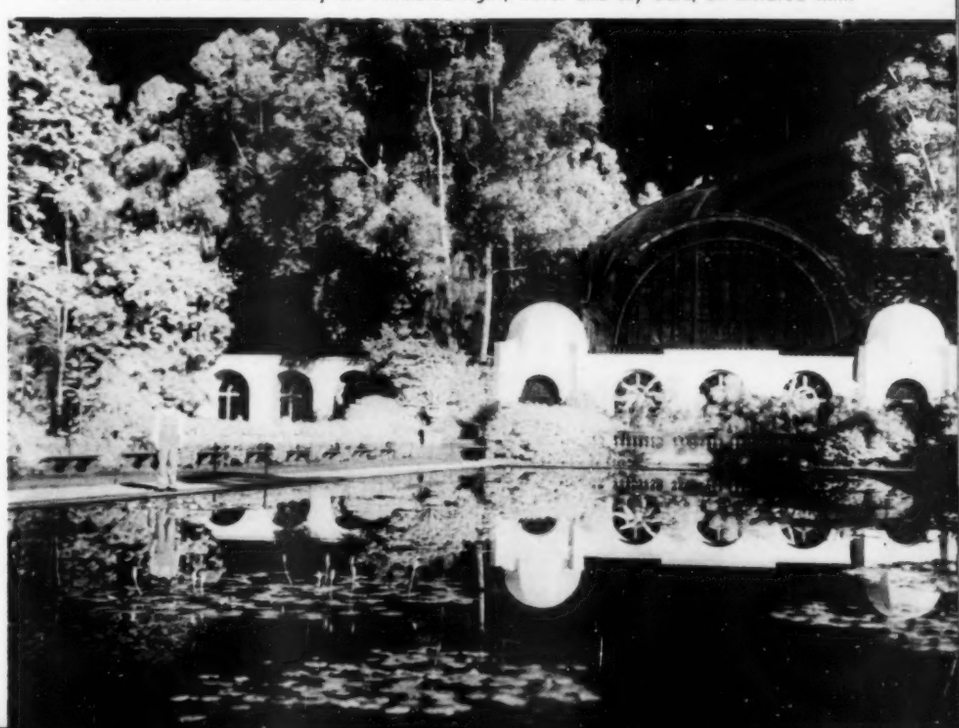
Infrared film has been treated with special dyes so that it is sensitive to a small portion of the visible red end of the spectrum and beyond into the invisible infrared. It is also sensitive to a part of the blue-violet end of the spectrum. That is where the use of an orange or red filter comes in. Either of these filters will bar the passage of blue-violet light and will admit only red light and the infrared radiations to react upon the film.

When you purchase a roll of infrared film, you will find enclosed an instruction sheet which will give you the recommended exposure for the film. This is usually 1/25 second at *f* 4.5 or *f* 5.6. If your camera does not have a lens as fast as either of these speeds, the equivalent exposure can be readily determined for smaller apertures. This recommended setting may not be correct for your particular lens, however. Some lenses pass more infrared than others, and a bit of experimenting might be required in order to determine the correct exposure for your lens. In my own case, I found that 1/10 second at *f* 4.5 with a deep orange filter gave me the best results. All of the pictures you see illustrating this article were made at that exposure and aperture. I used a 9x12 cm Recomar 33 camera and Eastman Infra-Red Sensitive plates.

To determine the correct infrared exposure for your own equipment, set up your camera on *one* particular scene, with the sun at your back. Then make an exposure at the speed and aperture recommended by the film manufacturer. Follow this with a shot at *one-half* the recommended exposure and another at *twice* the recommended exposure. One of these is bound to be better than the

(*Continued on page* 109)

Infrared shot with striking cloud formations shows tourists in a field of wildflowers. Deciduous trees and shrubbery are rendered light, water and sky dark, on infrared film.



Above is the author's first closeup of a horse, snapped soon after he became interested in photography. Two years later, after practicing and studying pictures, he took the fine shot at the left. It is No. 3 in the series taken to show his progress in this type of picture taking. Note improvement in composition and general print quality when it is compared with No. 1, above.

Is Your Photography Improving?

Improvement in exposure and darkroom technique is brought out by these pictures. No. 1, below, was underexposed and poorly printed. No. 2, taken a year later, shows proper exposure and development.

Choice of a better camera angle for No. 2 in this series, right, made it an improvement over No. 1, below. This comparison is inaccurate, however, as the weather was not the same for both pictures. Whenever possible, the lighting should be the same.

by Dr. G. M. Relyea

You can make sure that your pictures get better from year to year by taking repeat shots of a few of your favorite subjects.

ARE you making better pictures now than you were a year ago?

"Why, of course," you may answer. "What a question!"

But, are you sure? And, if you are certain that they have improved, do you know how much? Here's a way you can evaluate your work every once in a while, to check up on your photographic progress.

Some photographers are content to go on without knowing whether they are taking better pictures this year than last. Others remember their early attempts and take it for granted that they are doing better every year. It is possible to make a sort of rough estimate, of course, by remembering that you once got only 6 good negatives on a 12-exposure roll, and now you usually get at least 9. Or you can go through some of your old prints every so often and say, "Well, I guess I must be doing better now. I don't double-expose or cut off heads any more."

Such vague estimates have their value, but they are really not definite enough or well enough planned to prove anything. At least, I don't find them satisfactory. I like to know how I am doing, and have worked out a plan that has proved its worth during the past three years. Here's how it started.

Each June I travel to the East for my vacation, following the Lincoln highway. On the second trip after I became interested in photography, I found myself noticing the same landmarks I had on the first, and photographing many of the same subjects along the way. The weather was about the same, and the subject matter was no different. Everything was constant except my picture-taking ability, yet the pictures were far from alike. So it occurred to me that I could take pictures of certain subjects, year after year, and thus keep track of my progress.

(*Continued on page* 103)

By moving closer and shooting through an opening in the trees to eliminate unnecessary details, the author got a better picture of this steeple on his third attempt.

HOW MUCH LEEWAY In Color Exposure?

By W. NORWOOD BRIGANCE
Wabash College, Crawfordsville, Ind.

The author made practical tests to determine the latitude of Kodachrome film. Here are his findings.

EVERY color photographer knows that Kodachrome has less latitude than black-and-white film. Two questions, therefore, confront the users of this color film. First: How much latitude does Kodachrome really have? Second: What can be done, if anything, about pictures where the scene has a brightness range greater than the latitude of the film?

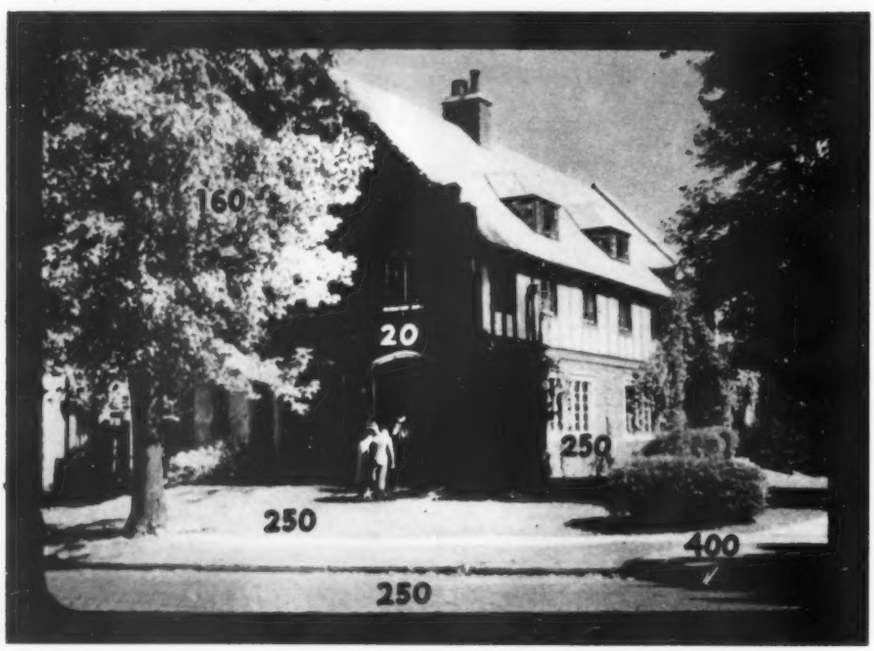
Generally speaking, black-and-white films have a latitude of about 128, latitude being the ratio of maximum to minimum exposure between which a film will yield good reproduction. It is determined by the characteristic (H & D) curve. Many exposure meters have this range marked on their dial, and by these markings you can determine whether both the brightest and the darkest object in any scene can be recorded on the film.

Meter manufacturers, however, do not make this same provision for color film. They simply give a conservative rule to follow, suggesting that you take a close-up reading for the darkest color and the brightest color in the scene and use the reading halfway between these two. The subject of latitude for color film is not as simple as for black-and-white, there being no characteristic curve available to serve as an accurate guide. I have, therefore, made some practical experiment, findings from which may be of help to other users of color film.

The question of good color photographs introduces a personal element. For example, when does an overexposed color become too faded to be considered "good"? And when does an underexposed color become so dark that richness fades into blackness? On a black-and-white film this is determined by the *tone*—the scale or range of half-tones—that comes out on the print. Of course, this is not simple even with black-and-white, but only the element of tone is involved.

Not so with color. When colors are diluted with white light—and that is what happens when an object is overexposed in color photography—what happens? First, the colors are changed in *tint* or brilliance of hue. To illustrate what this means, suppose we had a tub of blue paint. Then suppose we dumped a bucket of white paint into the tub of blue paint. The mixture would still be blue paint, but of a different *tint*, or brilliance of hue. That is what happens when a color film is subjected to too much light.

Black-and-white enlargement from a 35 mm color shot discussed in the text. Numbers represent meter readings for light and dark areas of the original scene, as indicated.



Second, its *color richness, saturation,* or *chroma* (all three words are synonymous for this phenomenon) is reduced. That means that (1) its intensity is weakened, and that (2) its purity of color is reduced; there is less difference now between one color and another—say between blue and red—than there was formerly. All colors now more nearly resemble gray of the same brilliancy.

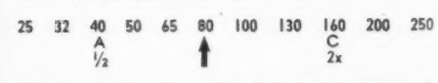
The world, however, abounds in colors of different tints and different degrees of color richness. Take a violet and overexpose it; the color comes out orchid. Overexpose a dark red flower; some shades at least will come out vermilion. Almost any red rose can be faded by overexposure to look like a pink rose. In nature there are many tints and many degrees of color richness. If you overexpose a dark color it can appear in the transparency like a lighter color found in nature, and therefore seem natural to the eye.

In short, an object overexposed or underexposed in color photography may come out like some other natural tint that our eye is accustomed to seeing. A color picture does not always need to capture the exact tint and color richness of the original scene in order to be good. Indeed, the tint and color richness of the original scene will change from sunlight to shade, from early morning light to noonday light, and from summer sunlight to fall and winter sunlight. It is not the "same color" at all times, so if our color picture of it is not exactly like the scene at the moment the exposure was made, that does not matter at all, so long as the difference is not greater than the eye is accustomed to seeing.

Therefore, whether an object *seems* overexposed or underexposed may depend on your or my own individual opinion, on our color memory, or even on our taste in colors—whether we like rich colors or more delicate tints.

On the basis of this observation I have worked out a latitude scale for Kodachrome that suits my personal taste in tint and color richness. If your tastes differ from mine, or if your projector throws more light or less light on the screen (you see, this enters in, too!), you can change the scale until it fits your taste and your apparatus. I find that within a latitude of 10 I can get results that suit my taste splendidly. That is, so long as the darkest object in the picture gives a reading that is 1/10 as great as that given by the brightest object, both objects will have a tint and color richness that satisfies my eye.

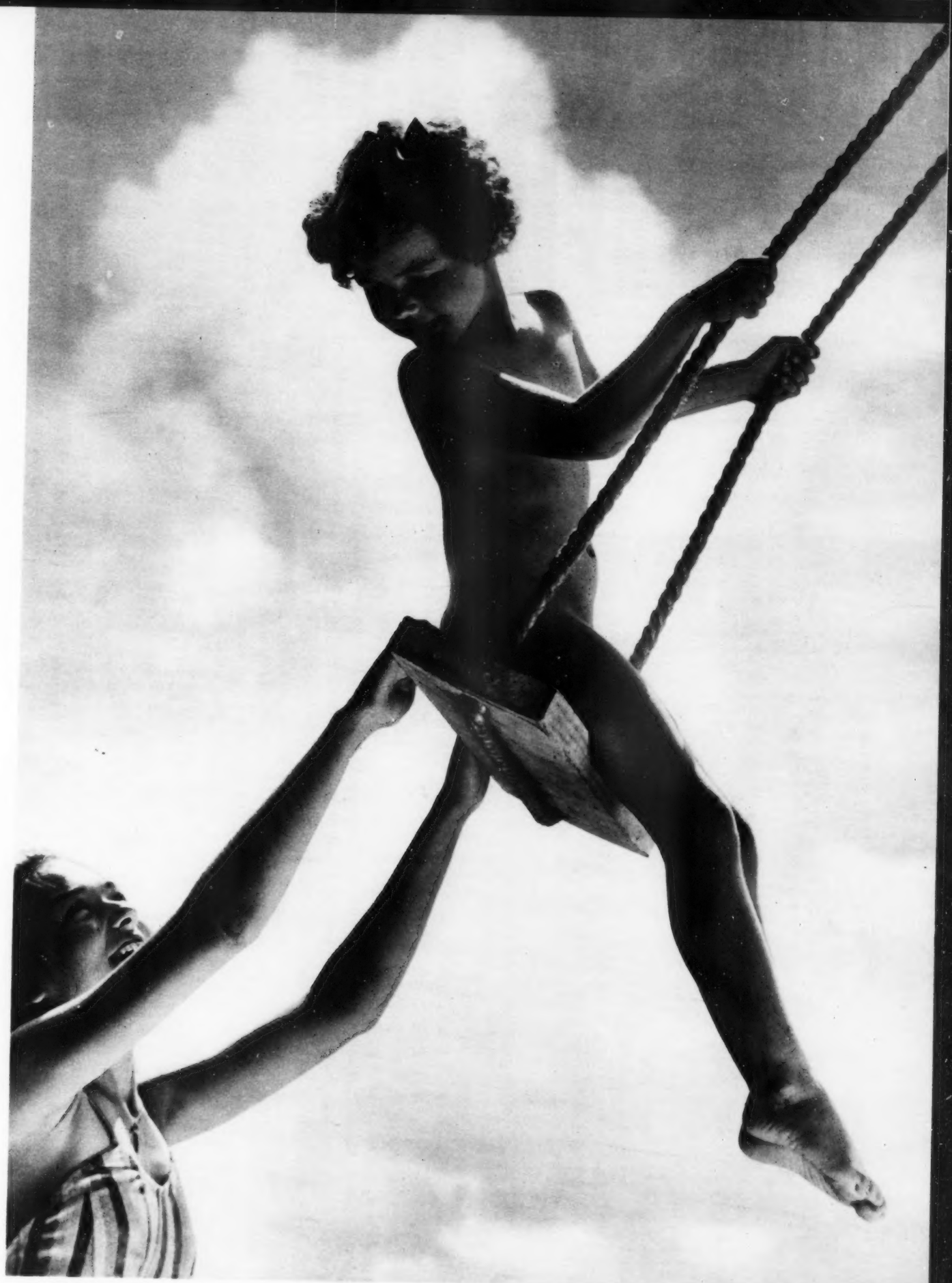
Let's set down some typical light value markings using, for example, a Weston meter, and see how this works:



If the brightest object measures 250 and the darkest object is not below 25 (1/10 as much), then I can expect to get satisfactory shades from colors giving readings at both extremes. To do this I set the arrow on the meter at a point halfway between 25 and 250, which would be at 80 (see above diagram), and compute

(*Continued on page* 92)

Salon Section



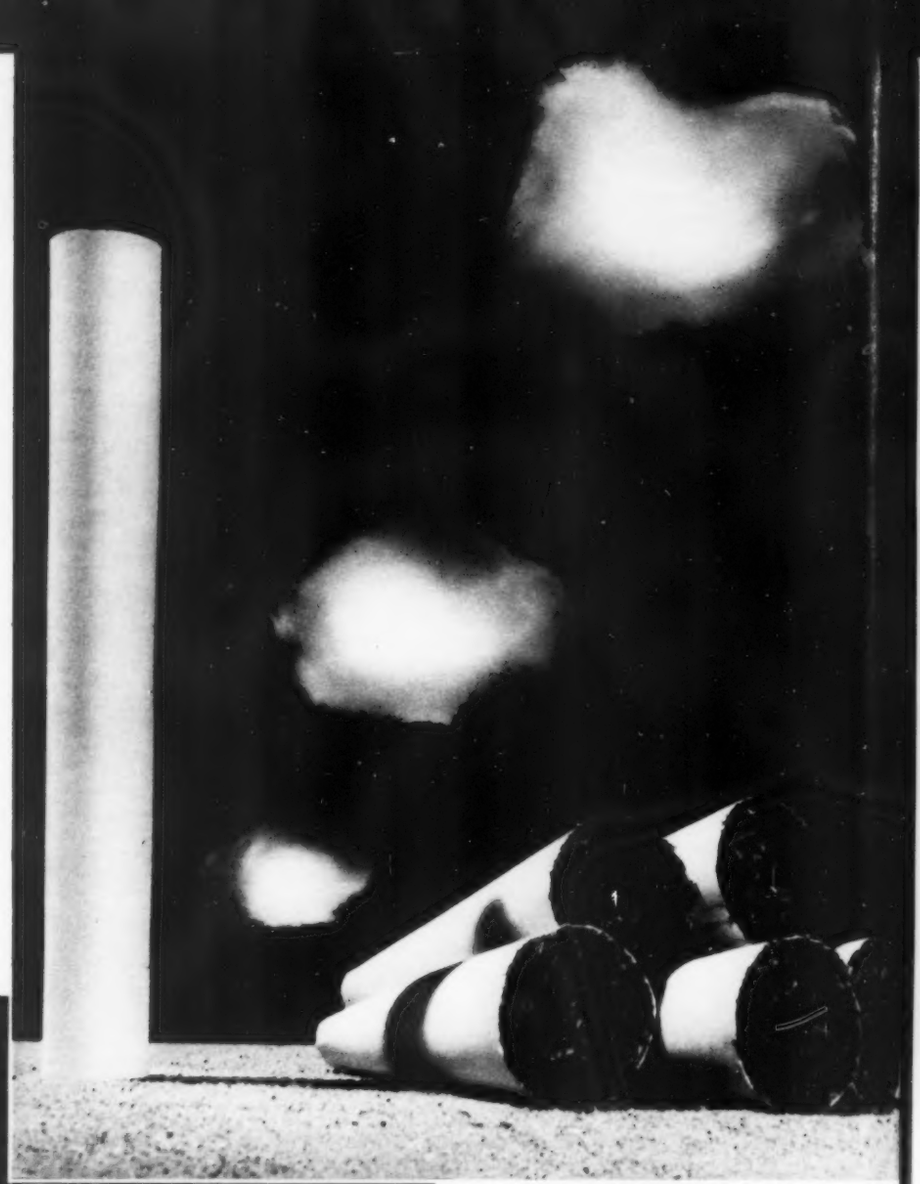
SWING HIGH

By THOMAS E. BENNER

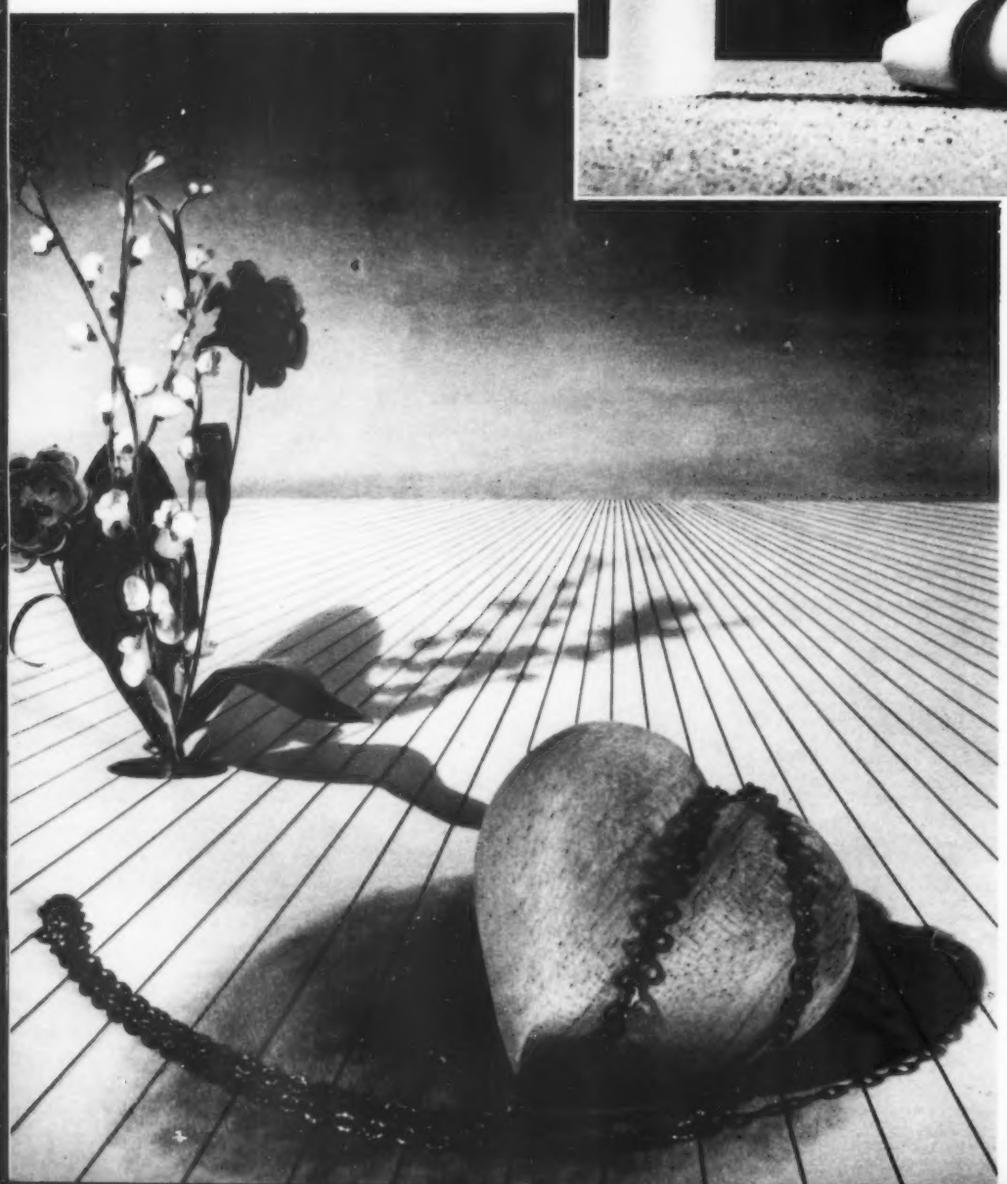
SURREALISM

NEW movements in painting have their counterpart in modern photography. The camera will produce surrealistic pictures as well as the artist's brush. The main difference is that the photographer must arrange his setup with care and use tricks in printing to create the effects he wants.

(For Technical Data see page 90)



PERSPECTIVE.....by
Watson Lewis, Hollywood, Calif.



THINGS PAST.....by
William Langdon, Chicago, Ill.

COOLING

THERE are as many different ways of expressing any one idea in pictures as there are photographers. Both these pictures are based on the same general appeal—keeping cool—yet each uses different subject matter.

(For Technical Data see page 90)

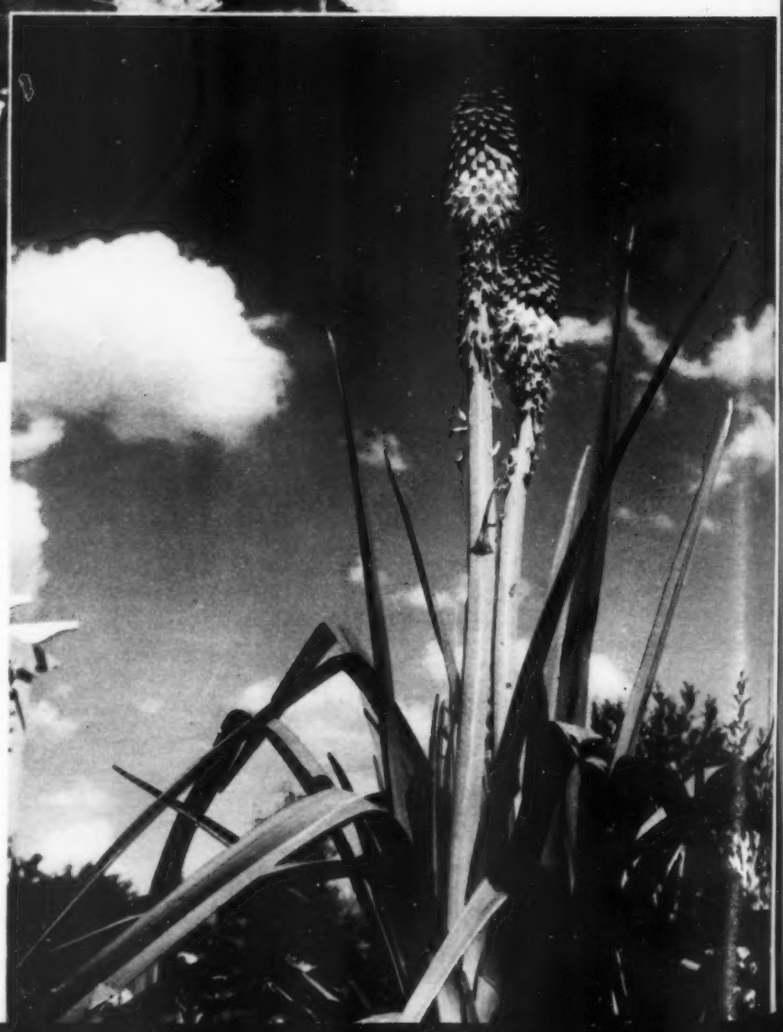
THIRSTY.....by Arthur J. O. Romero, Riverdale, N. Y.

CURBSTONE SHOWER.....by Marian Manning, Vienna, Va.

TWO FIGURES

PAIRS of foreground figures are much harder to pose than single ones, whether they are used to lead the eye into landscapes or as main subjects. B. W. Leroy, Portland, Ore., employs them both ways in these photographs.

(For Technical Data see page 90)



FLOWERS

A LOW camera angle shows many summer picture subjects at their best against a background of sky and clouds. LeVerne K. Osdal, Rapid City, S. Dak., snapped these hollyhocks and tritomas from the ground, awaiting clouds to help the composition.

(For Technical Data see page 90)

By TORREL KORLING

SATISFACTION

By TORKEL KORLING

INTO THE
STRETCH

OUTBOARDS

REACH

Action

WHETHER you take your summer sports as participant or spectator, you will find that they offer many opportunities for action pictures. William M. Rittase of Philadelphia, Pa., snapped these varied subjects.

(For Technical Data see page 90)

DOUBLE DIVE

FIREWORKS.....by V. F. Melchore, Queens Village, N. Y.

TRACES

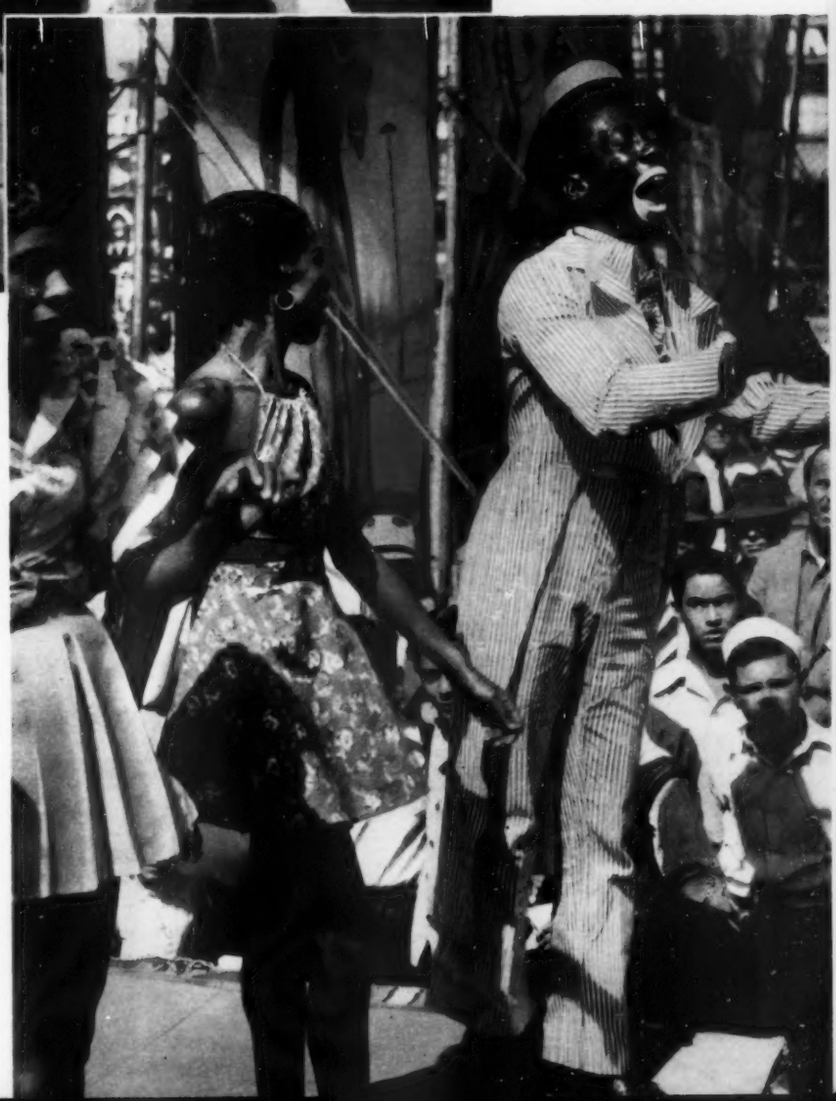
INTERESTING patterns can be caught on film by photographing moving lights against the background of a night sky. To show the lights as trails instead of dots, use a long time exposure.

(For Technical Data see page 90)

FLYING HIGH.....by Frank Paine Baldwin, Morristown, N. J.

STEP RIGHT UP!

MAMMY!



SIDE-SHOW

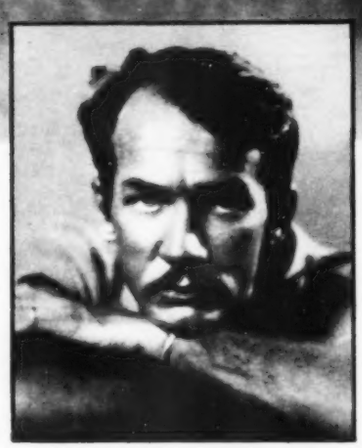
WHEN the circus comes to town, there are many pictures to be taken. Watch the side-show barkers. When they call out a few performers to draw a crowd, you can photograph the show right out in the open as Peter James Samerjan of Hollywood did.

(For Technical Data see page 90)

NEGATIVE

SOMETIMES you will find that your positive print isn't as striking a picture as the negative from which it is made. Ira Arnot, Coral Gables, Fla., made this paper negative in his camera. Compare it with the positive.

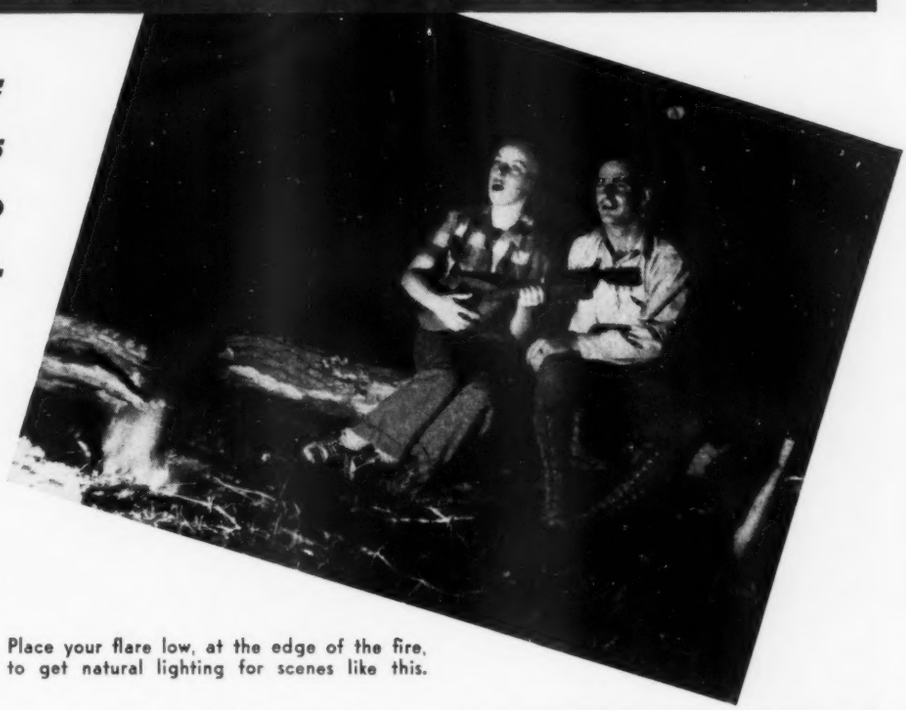
(For Technical Data see page 90)



CAMPFIRE MOVIES

By LOUIS ELL

You can get realistic night scenes outdoors by burning flares to step up the firelight.



Place your flare low, at the edge of the fire, to get natural lighting for scenes like this.

MAKING movies around a campfire after dark, where electricity is not available, sounds like a tough assignment. Actually, however, it's almost as easy as taking ordinary indoor scenes at night. Photographic flares or magnesium ribbon will give you light enough to get good pictures, even without a high-speed lens.

Flares, which can be obtained from photo supply houses, come in several sizes. They burn from 30 seconds to 5 minutes. The 30-second ones will do for most amateur use, and if you have everything planned out before you start, you can shoot two or three closeups with a single flare.

Fast panchromatic film should be used, and the lens should be opened to its widest aperture for most pictures. To get bright flames in your scenes, build the campfire with wood that is dry and well seasoned.

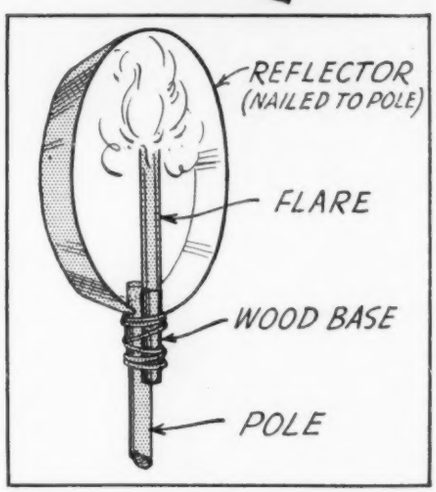
Silhouette scenes showing people moving about between the fire and the camera can be made with no other illumination than the flames themselves. With the lens wide open, some detail in faces and clothing may register very near the fire. If your camera is equipped to run at half speed, instruct your actors to move just half as fast as they normally would. By shooting at half speed, you allow twice as much exposure, and the screen picture appears normal if your subjects have moved slowly enough.

Silhouette shots cannot make an interesting movie of any length by themselves. Closeups in which detail, action, and facial expressions comes through clear and strong must be included. These cannot be obtained with any consistent success using only the natural light furnished by the fire.

Good campfire closeups can be made by "boosting up" the photographic quality of the firelight. One easy and convenient way to do this is to burn magnesium ribbon in the flames.

This ribbon can be obtained in rolls, cheaply, from any chemical supply house. One roll is sufficient for several scenes. It gives an intense, white light, that enables you to use normal camera speeds,

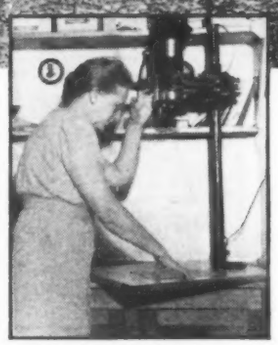
(*Continued on page* 109)



A tin pan makes a good reflector to keep the direct light of flares from the lens.

Magnesium ribbon was burned to light the scene below (left). The marshmallow roast shot (right) was "faked" by placing a floodlamp near a fire built in the author's back yard.

To help her mother out, Mim Keeton waded into Lake Superior on a bitter cold day for this picture.



Mrs. Mildred Keeton in her pantry darkroom.

HOUSEWIFE TURNS PHOTOGRAPHER

by JOE WOODY

Starting at the beginning in photography at middle age, this Michigan lady has won fame and money with the pictures she turns out.

TAKING up photography as an adult—and as a busy housewife and mother, at that—Mrs. Mildred Keeton, of Munising, Mich., has made editors and salon judges alike recognize her prowess with a camera.

Approximately a decade ago, her eldest son's health began to fail. During his last illness he succeeded in interesting his mother in photography. At his request, Mrs. Keeton purchased a Graflex and accessories, and let the bed-ridden youth get her started in learning to take pictures. Upon his passing, she took up her photographic studies with renewed vigor. Today her inventory of cameras and darkroom equipment reads like a photographic catalog—and she can use every known gadget with the skill of a master.

Far more interested in crocheting and exchanging recipes with the neighbors, Mildred Keeton knew nothing about cameras for many years. Her first shot was to be a portrait of a friend standing beside a gasoline pump. But she'd loaded the film backwards, and the exposure was a failure. She spent many tedious hours paging through instruction books and other literature in an effort to acquire a working knowledge of photography.

The first Keeton darkroom was nothing more nor less than the fruit cellar. Mrs. Keeton loaded her first film while seated on a sack of potatoes. Later a carpenter was called in to wall off a basement corner and cut a hole in the ceiling for the enlarger dome. But the basement proved

Left: Rushing to get this shot while conditions were just right, Mildred Keeton climbed two barbed wire fences, ripped a pair of stockings to shreds.

Below: Old people and young children are favorite Keeton subjects. This informal closeup of an old mariner was taken aboard a Great Lakes fish tug.

too damp, and the darkroom was moved bodily up to the second floor of the Keeton home. This worked all right until the rest of the family complained about the bath-tub being used for washing prints. The upshot was that the kitchen was remodeled and the pantry turned into a darkroom equipped with heat and running water.

For many months Mrs. Keeton's progress in her new hobby was discouragingly slow. She regularly took long walks, looking for likely picture subjects. She went without a new coat in order to buy a set of good filters. Then all of a sudden a closeup shot of a smiling baby won her a camera in a tooth-paste prize contest. A snapshot of a kitten pawing a cream bottle brought her a $5 prize in a dairy competition. And to cap the climax, a newspaper paid her $4 for an action shot of a pole vaulter.

Never before had she thought of the financial possibilities of picture taking. But with these first few encouragements she plunged into photography deeper than ever, toting a heavy camera around to lumber camps and Indian pow-wows, photographing clouds and sunsets, vases and fruit. She waded trout streams, climbed out on log jams, and filmed forest fires.

Once the Keeton home had been an outstanding example of dust-free tidiness. Now it became littered with photographic prints, cameras, and every conceivable gadget. But the picture pastime proved highly contagious, and before long Mrs. Keeton's younger son and daughter were going on camera hikes with her and acting as models. Even her husband, hitherto apparently immune to the beauties of Nature, would come home raving about picturesque cloud formations and color-drenched sunsets. Mim, the daughter, proved to be an ideal model, and her publicity poses have helped to advertise Michigan's Upper Peninsula.

Sometimes the camera antics of Mother embarrassed the children, particularly the time when Mrs. Keeton climbed the sloping school-house roof to take an angle shot of a nearby church in flames. The structure was still smoldering when her postcard pictures of the disaster went on sale in local drugstores.

Then there was the subzero winter when the Au Train river froze tight at its mouth. Local authorities decided to blast in order to break the ice. In hands so numb that she could hardly squeeze the trigger, Mrs. Keeton gripped her camera, waiting to photograph the blast of dynamite. As she waited in the bitter cold, she remembered that she had accepted a party invitation for that afternoon. So once again she caused some embarrass-

(*Continued on page* 112)

Her ingenuity in getting this youngster to pose with a couple of fish from the market rewarded Mrs. Keeton. This shot won a prize in a Detroit newspaper contest.

CREATE DISTINCTIVE PRINT LABELS

By

WALTER E. BURTON

You can design personal labels to identify your pictures. Here are tips on how to make them up.

Clever photographic labels "dress up" the backs of your pictures and provide a positive means of identification at the same time.

IF you send prints to salons or contests, make them up for club exhibits, or sell them in folders or frames, you can mark them as your own by using photographic labels. Of course you can have labels printed with type, or buy a rubber stamp, but few true print-makers are satisfied with anything less than photographic stickers.

It is surprisingly easy to make such labels. The possibilities are endless, for you can combine photography with hand lettering and art work to make up any sort of design you may desire. A few of the best methods are described here.

To make a label, you work up an original design, photograph it on a suitable film, and then make a positive print on a thin, smooth-surfaced paper. For convenience in applying the label, you coat its back with a gum that dries like the glue on a postage stamp and is handled in the same manner.

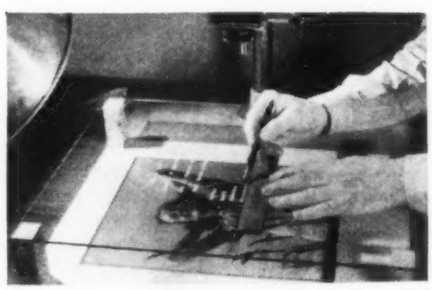
For copying letters so as to produce greatest contrast, use process film. Avoid overexposure, and develop fully for greatest contrast. If the transparent areas of the negative, produced by black in the original, look veiled over, treat the negative with Farmer's reducer until they are clear. The surrounding areas should remain opaque. For copying pictures, drawings, and lettering in which there are graduated tones, use a medium-speed, commercial orthochromatic or panchromatic film. In some cases, a process negative and one showing graduated tones can be combined in printing.

Labels should be printed on rather thin paper. Any kind of singleweight paper having a smooth, semi-matte surface can be used. A label can be a straight black-and-white print, or it can be dressed up by toning. For convenience in coating with mucilage, it is a good idea to print labels in groups on 8 x 10″ paper, and trim them to size after coating. Simple cardboard masks can be used for printing 4, 6, 8, or more labels on a single sheet of paper.

You have a wide assortment of stunts from which to choose when making a master or dummy label to be copied with a camera. The letters in any movie titling set can be used to spell out a practical print label. These are characters printed on cardboard rectangles, cut out of wood, metal, rubber, or plastic, or magnetic metal letters that adhere to a sheet of iron. If you buy a titling outfit mainly for label-making, get one having cut-out letters that can be laid on a sheet of glass, like alphabet-soup letters.

Set up the label in accordance with

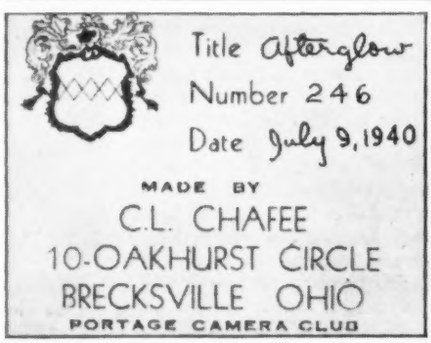
(*Continued on page* 116)



To make labels with a portrait background, place letters on glass above the picture.

Lettering and a photograph were combined for this attractive print label.

Any design, like this family coat of arms, can be included in a photographic label.



For an unusual effect, have the printing set in type and then take a picture of it.

BE SURE TO ENTER THE $6,000.00

Once again, POPULAR PHOTOGRAPHY is holding the biggest picture contest ever conducted by any photographic magazine. It's open to all comers, and a total of more than $6,000 in cash and merchandise prizes is being offered this year. Anybody can compete, and you can send in as many photographs as you wish, black-and-white or color, "straight" or retouched. Human interest as well as photographic quality will determine the awarding of prizes.

Popular Photography PICTURE CONTEST

228 PRIZES

CLOSING DATE SEPT. 2, 1941

Over $2,300 for COLOR

1st — $720.00

14-day all-expense luxury cruise for 2 to Trinidad and the islands, on liner operated by Alcoa Steamship Co., Inc. Fare includes special deluxe bedrooms, private bath. In case of national emergency, tickets will be honored when traffic is resumed. Value of each ticket 360.00.

2nd — $204.10

First-class round-trip tickets for 2 from New York to Miami, Fla., on the Orange Blossom Special of the Seaboard Airline Railway, including sole occupancy of bedrooms on train. Value of each ticket 102.05

3rd — $109.00

4 x 5 Korona View Camera, 40.00; Turner-Reich f 6.8 convertible anastigmat lens in shutter, 62.00; carrying case. 5.00; 1 holder 2.00.

4th CASH — $100.00

5th — $98.00

Ampro Model A-8 movie projector, for 8mm film; 1" f 1.6 lens; reverse; single-frame device; pilot light; rheostat control, variable speed; flickerless projection at slow speeds; 200' reel, lamp, case.

78 OTHER PRIZES IN COLOR CLASS

Over $3,700 for BLACK & WHITE

1st — $1,200.00

1942 Packard 4-door Touring sedan, completely equipped. Approximately $1,200.00.

2nd — $600.00

Luxury all-expense cruise for 2 to the Caribbean, stopping at San Juan, St. Thomas, Port au Prince, and Havana, on S.S. "America," of the United States Lines. In case of national emergency, tickets will be honored when traffic is resumed. Value of each ticket 300.00.

3rd — $140.00

Revere Model 99 double-8 movie camera and Revere Deluxe Model 85 projector. Camera has 3-lens turret; 5 camera speeds. Projector has rheostat speed control; clutch control for stills; f 1.6 lens; 500-watt lamp. Camera, with 12.5 mm Wollensak f 2.5 lens, 65.00. Projector and case, 75.00.

4th — $102.05

First-class round trip for one from New York to Miami, Fla., on the Orange Blossom Special of the Seaboard Airline Railway, including sole occupancy of bedroom.

5th to 8th each $50.00

145 OTHER PRIZES IN BLACK & WHITE CLASS

RULES OF CONTEST

1. Contest open to all, except employees of the Ziff-Davis Publishing Company, POPULAR PHOTOGRAPHY, and their families.
2. Submit any number of black-and-white prints, color prints, or color transparencies. Tinted black-and-white prints and montages not eligible. Any size prints may be submitted, although 5x7 or larger are preferred.
3. Excluded from the contest are pictures which have been published by any photographic magazine in the United States. Publication in other form does not make pictures ineligible.
4. All photographs must carry on the back the typewritten or printed name and address of entrant. Attach securely to every entry a filled-in entry blank (see below) or a facsimile. Additional blanks can be obtained from photo dealers and finishers.
5. Pictures will be returned only if a self-addressed and stamped envelope, or label and postage are contained in the same package. While exercising utmost care in handling, POPULAR PHOTOGRAPHY does not assume any responsibility for the loss or damage of entries.
6. Address all entries to Contest Editor, POPULAR PHOTOGRAPHY, 608 S. Dearborn St., Chicago, Ill.
7. The Editors of POPULAR PHOTOGRAPHY will be the judges in the contest. Their decision is accepted as final by all contestants.
8. All entries must be in the hands of the Contest Editor by September 2, 1941. The winners will be announced in the December issue of POPULAR PHOTOGRAPHY. In case of ties duplicate prizes will be awarded.
9. Prize-winning prints and transparencies, including reproduction rights, become the property of POPULAR PHOTOGRAPHY. Negatives of prize-winning pictures must be loaned to POPULAR PHOTOGRAPHY for 3 months.
10. The Contest Editor regrets that he is unable to entertain correspondence of any kind regarding entries.

Descriptive folders, with entry blanks and a complete listing of the 228 prizes, are available from camera dealers and photofinishers. Or write the Contest Editor, Popular Photography, 608 S. Dearborn St., Chicago, Ill.

USE THIS ENTRY BLANK

Contest Editor, POPULAR PHOTOGRAPHY
608 S. Dearborn St., Chicago, Ill.

1941

Please enter the enclosed picture in your 1941 Picture Contest.

Name ..... Street .....
Town ..... State .....
Picture title .....
Camera used ..... Lens .....
Lens stop ..... Exposure .....
Film used ..... Filter .....
Paper ..... Lighting .....
Published before in .....

Two negatives were used to print this picture. A third, showing a window frame, could easily have been added if desired.

CLEVER SILHOUETTES CAN TELL A STORY

by STAN JENKINS
Illustration Photographer, Utica, N. Y.

Easily made with any type of camera, silhouettes offer something strikingly different in pictures.

WHEN you want to take time off from the struggle to capture subtle gradations of light and shadow on film, you'll find a refreshing change in making silhouettes. Sometimes a silhouette photograph will tell a story better than when full detail is shown. And silhouettes lend themselves admirably to the making of posters, bookcovers, fireplace screens or score-pads.

There are several methods of making photographic silhouettes. The most common way is to stretch a sheet across a doorway with a strong light behind it and the subject in front of it, photographing the subject against the light. Another indoor method can be used when a plain white or light-colored wall is available. Light the wall uniformly from the sides, as you would a copy easel, and photograph the subject against this.

Silhouettes can be made outdoors as well as inside, by placing the subject in an elevated position and shooting against the sun. You can vary this procedure by placing the subject in the shade of a tree or in a doorway and shooting against the sky. Exposure should be for the sky, of course, with the subject being underexposed so as not to show detail.

You can make silhouette pictures from any of your present negatives which are suitable for the purpose. Make an enlarged positive on film. On this positive paint out with opaque the portions which are to be white in the ensuing print, and remove (by means of scraping or local reduction) those portions of the image which are to print black. Then use the retouched film positive as a negative.

A somewhat similar idea is to make a large print from any negative from which you want to make a silhouette, and then use ink or paint to render various areas black or white as desired. When this has been done, shoot a copy of the print and make reductions or enlargements from the copy negative.

Multiple printing from silhouette negatives has many possibilities, too. You can, for example, print a boy from one negative, a dog from another, and a tree or some foliage from a third, all on one sheet of printing paper. When you become accustomed to multiple printing you can get various tones in the same print, by varying your exposure times.

Best results are obtained in all cases by using a high-contrast film and a corresponding developer. The same general rule applies to making the prints.

The suggestions offered herewith merely point the way in silhouette photography. This type of work is certain to afford you many interesting experiences with your camera and in the darkroom, presenting so many opportunities as it does. You'll see when you try it.—

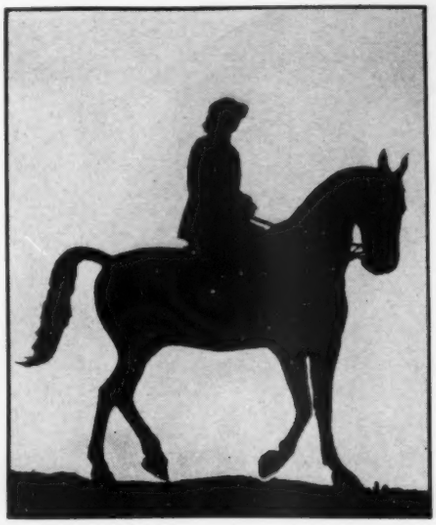
Silhouettes can be used in studying composition, as shown here. The subject sat in front of a sheet lighted from behind.

People at work, as well as at play, are good silhouette subjects. And a real likeness results with the face in profile.

An ordinary negative can be used to make an enlarged positive or negative. This can be opaqued for silhouette printing.

Sports poses make good silhouettes. They can be shot outdoors against the sun. Use ortho film, and develop it for contrast.

Silhouettes of children provide unique keepsakes. This picture was posed on a broad wall, against a bright, clear sky.



Using a regular enlarged photograph, you can obtain this effect easily by painting over it with black and white inks.

A shot like this makes a good book-plate design. Leaves at upper left were printed from a separate negative, for balance.

Here the background was opaqued on the original negative, and the figure made to print black by means of overexposure.

Reverse designs are unusual. An enlarged positive or negative print on matte paper is painted over in black and white.

This sort of shot will serve as a cover design for a score-pad. Or it can be enlarged for a calendar or a fire-screen.

In double printing you can enlarge or reduce either subject to alter its relationship or perspective, as in this shot.

Monuments and statuary often provide subject material not found elsewhere. It can be used alone or in multiple printing.

A series of silhouettes like this and the one in the upper left corner of the page can be used to decorate a child's room.

For your protection, mark every print of a copyrighted picture. An easy way is to put the symbol on the original negative.

Copyright YOUR PICTURES

by ALFRED TOOMBS

You can establish the exclusive right to sell your valuable photographs by having them copyrighted. Here's how to do it.

YOU can make sure that you will enjoy the profits from your prized pictures by copyrighting them. The United States Government protects inventors and creative artists from those who would steal their ideas. Photographers are among those who can take advantage of this protection—but probably not one in a hundred realizes it.

The large photographic agencies, and many professional photographers, take advantage of the protection offered by the copyright laws. Smaller professional studios, and most amateurs, who don't expect to make much money with most of the pictures they take, pay little heed to the copyright office.

You should know more about it. Perhaps most of your pictures are taken for fun rather than profit, but you are bound

When questions come up in regard to photographs which are received for copyright, they are referred to a revisory board which meets every day.

Right: After your photograph has been copyrighted, it is placed with millions of others in the permanent files of the Library of Congress.

to get some that will be valuable. Here's how to protect your rights to them. Many photographers have come to regret their failure to copyright fine pictures which made lots of money—but not for them.

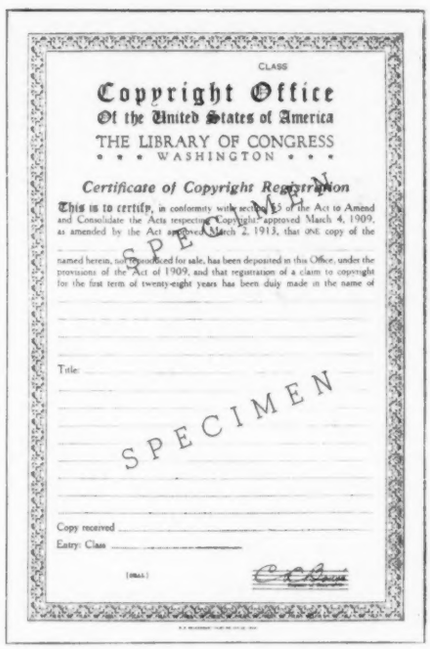
The Register of Copyrights, in the Library of Congress, Washington, D. C., administers the agency set up under the copyright law. This law has its basis in the Constitution, which gives Congress the power "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." The first law providing for copyrights in this country was passed in 1790, and in 1865 the law was amended so as to include the young art of photography. The Supreme Court later held, in a case relating to a photograph of Oscar Wilde, that the amendment was constitutional—ruling the photographs are "writings." The law which is in operation now was passed in 1909.

The basic idea behind copyrighting a photograph is simple enough. But like many another simple idea, it has become quite complicated. The first step, and one which all photographers would be wise to take, is to obtain from the Register of Copyrights a supply of registration forms. A letter will bring them.

Under the copyright law, photographs are divided into two classes, published and unpublished. These terms are not used in the ordinary sense, but have a particular meaning to the copyright office. This fact has tripped more than one photographer.

Publication under the copyright law does not mean that the photograph has appeared in some newspaper, magazine, or other periodical. Publication means that you have produced the photograph in quantity and offered it for sale generally—which may or may not include publication in a periodical. If you have made a photograph of a group of people and have offered a dozen or so prints to them for sale, you have published the picture. Of course, if you make only one or two prints, which you show around among friends or send off on speculation

(*Continued on page* 114)



CLASS

Copyright Office
Of the United States of America
THE LIBRARY OF CONGRESS
• • • WASHINGTON • • •

Certificate of Copyright Registration

This is to certify, in conformity with section 55 of the Act to Amend and Consolidate the Acts respecting Copyright approved March 4, 1909, as amended by the Act approved March 2, 1913, that ONE copy of the

named herein, not reproduced for sale, has been deposited in this Office, under the provisions of the Act of 1909, and that registration of a claim to copyright for the first term of twenty-eight years has been duly made in the name of

Title:

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SPECIMEN

If you pay a $2.00 fee, you will obtain a certificate of copyright registration. Without a certificate, the fee is $1.00.

Form used for pictures to be published at once. Back calls for photo title and name, address, and citizenship of photographer.

J1

2 c. rec'd.
Application rec'd.
Fee rec'd $

IMPORTANT. Applicant must not write in the blank lines above; to do so will cause delay in Copyright Office.

APPLICATION FOR REGISTRATION
PHOTOGRAPH REPRODUCED IN COPIES FOR SALE

REGISTER OF COPYRIGHTS, Washington, D. C.

Of the PHOTOGRAPH named herein, TWO complete copies of the best edition published on the date stated herein are herewith deposited to secure copyright registration according to the provisions of the Act of March 4, 1909. (1) *$_____ *statutory fee for registration is also inclosed. The copyright is claimed by*

(2) Name of copyright owner_____
(Write full legal name of copyright owner)

(3) Address_____ _____
(Street) (City) (State)

* If certificate is desired, the fee is $2; if no certificate, $1.

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Application used for pictures not published. Only one copy need accompany this form, which protects your rights for 28 years.

J2

1 c. rec'd.
Application rec'd.
Fee rec'd $

IMPORTANT. Applicant must not write in the blank lines above; to do so will cause delay in Copyright Office.

APPLICATION FOR REGISTRATION
PHOTOGRAPH NOT REPRODUCED FOR SALE

REGISTER OF COPYRIGHTS, Washington, D. C.

Of the PHOTOGRAPH named herein, not reproduced in copies for sale, ONE perfect copy is herewith deposited to secure copyright registration according to the provisions of the Act of March 4, 1909. $1 (statutory fee for registration) is also inclosed. The copyright is claimed by

(1) Name of copyright owner_____
(Write full legal name of copyright owner)

(2) Address_____ _____
(Street) (City) (State)

(3) Country of which the photographer is a citizen_____
(MUST be stated)

[Please turn this over]

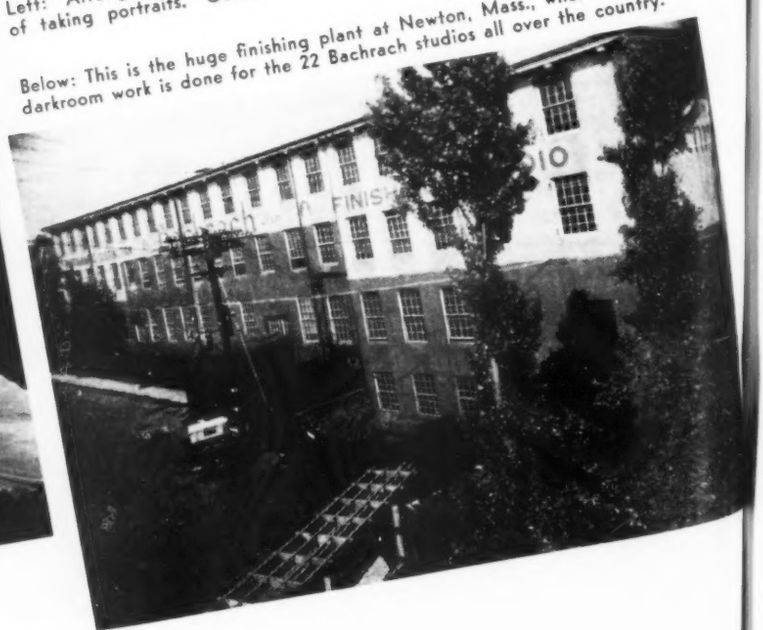
THE BACHRACH SECRET: "PUT THEM AT EASE"

by BERNADINE BAILEY

Above: You can't get pictures like this by asking your subjects to look natural. Put them at ease with interesting conversation instead.

Left: Arranging lights, focusing, and judging exposure is only half of taking portraits. Getting the right expression is the other half.

Below: This is the huge finishing plant at Newton, Mass., where all the darkroom work is done for the 22 Bachrach studios all over the country.



Children are less camera-conscious than adults. It is easy to snap good portraits of them by following the Bachrach formula.

You can catch true-to-life portraits of your subjects by making them forget that they are posing before the camera.

Portraits should show natural expression and have good technical quality. Here's how a big portrait studio gets them both.

IT takes a little work to make your portrait subjects look natural—but don't let them know it. Make them think there's nothing to it. Keep them at ease to get pictures they like—this is rule No. 1 of the Bachrach studios, which have been taking portraits since 1868. It works every day in their studios all over the country. Here are some tips on how they do it. You can adapt them to your own use, to help you get better home portraits.

Looking natural to order is one of the most difficult feats in the world. Don't tell your subject to smile, or look natural, or you are bound to get off to a bad start. The mouth may take on the curve of a smile, but the genuine feeling of a smile is not there. Instead, there is a forced, unnatural look that often makes people displeased with pictures of themselves.

The best way to start, according to the Bachrachs, is to get the subject to forget that he is having his picture taken. They get him engrossed in an interesting conversation. If it's a man, they talk about his business, sports, or politics. Once the right topic is found, his face softens into natural lines, interest and animation shine forth, and he loses his tension. Then he looks like himself. Not only is the facial expression a natural one, but the whole body—especially shoulders, arms, and hands—falls into a habitual, lifelike pose.

The photographer has already arranged all the mechanical details—lighting, focusing, aperture and shutter—and during the course of the conversation, while the subject's mind is miles away from photography, the picture is taken. The result is a "speaking likeness," a portrait that conveys a *personality*.

You will notice, in the accompanying picture of a white-haired man, that the subject is not smiling and is not looking directly into the camera. But you will notice, too, that there is an "aliveness" to the picture and an absolute lack of strain or self-consciousness.

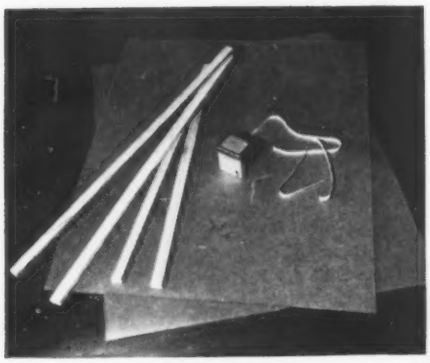
This same technique should be followed in photographing children, where naturalness is usually more easily achieved than with adults. The trick, of course, is to interest the child and to click the shutter at the exact moment when his expression is the one which you want to catch. Sometimes the effect is enhanced when the child's hair is tousled, and when he isn't dressed up too much.

The second important rule Bachrach photographers observe is to choose a suitable background. If the picture is taken indoors, a light wall forms a good background. The daylight should come from the left or right side, and a portrait should *never* be taken with the light falling directly on the front of the face. When the daylight comes from the right or left, it is well to have a flood lamp on the opposite side, in order to kill the heavy shadow that would otherwise result.

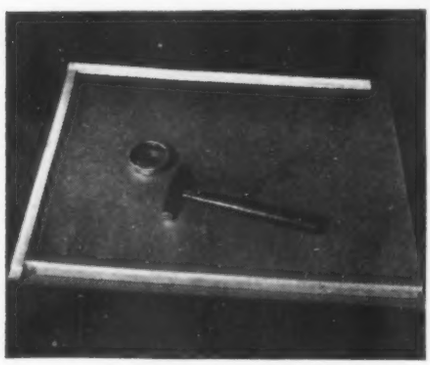
If the picture is taken outdoors, shrubbery makes an excellent background. Since it is dark, it supplies the needed contrast for the lightness of the face. But the shrubbery must be high enough to shut out from the picture any glimpse of sky. If it doesn't then the sky, by its lightness, will automatically change the center of interest or at least add a dis-

(*Continued on page* 107)

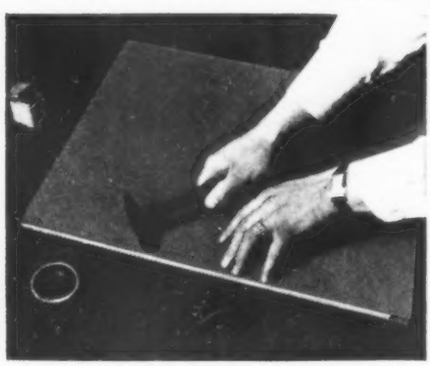
These home-made cases are easy to build. They will protect your salon prints from dirt and damage, both for shipping and storage at home.



Here are all the materials that you will require—strips of wood, sheets of cardboard, elastic, glue, and a few brads.



The first step is to notch the strips to fit at the corners, glue them, and tack them together on one of the cardboards.

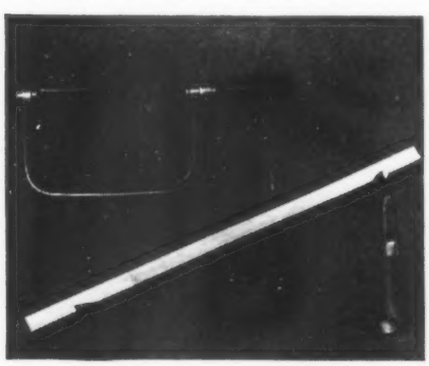


Then coat both sides of the wooden strips with glue, and nail the sheets of fiber cardboard to them. Use 5/16" wire brads.

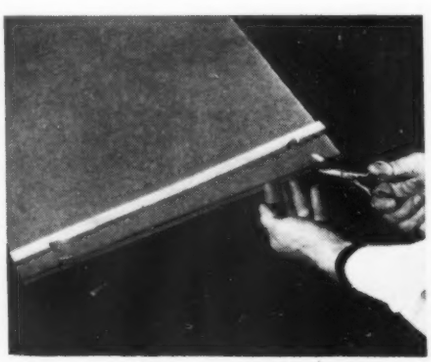
SHIPPING CASES FOR YOUR PRINTS

by WILLIAM HOFMANN

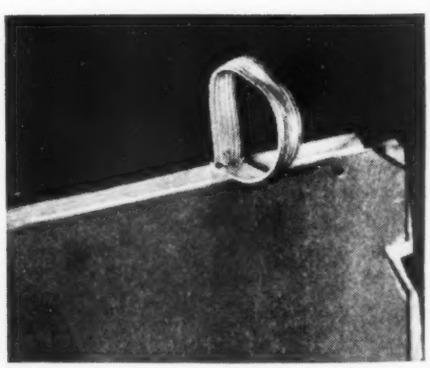
HERE is an inexpensive case you can make to protect your mounted pictures for shipping or storage. If you send prints to salons and contests, you may find use for several of these handy containers. They provide real protection for your salon prints, both against dirt and damage in handling. The only materials you need are 2 strips of wood, 5/16" x 5/8" x 20 5/8", 2 strips 5/16" x 5/8" x 17 1/4", 2 sheets of fiber cardboard, 17 1/4" x 21 1/4", a short piece of 1/4-inch elastic, a small can of glue, and some 5/16" wire brads. A small saw, a knife, and scissors or a razor blade are all the tools that are required.



Next, cut a strip to slip into the top of the case, notching it near each end for the elastic bands to hold it in place.



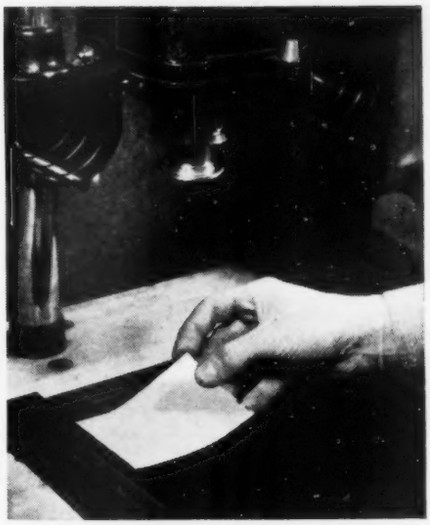
When the top strip has been cut to size and notched, make corresponding notches in the cardboard sides of the container.



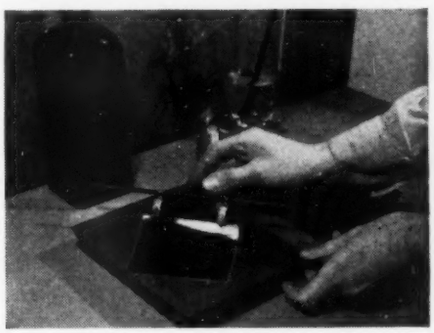
The last step is to tack the elastic to the frame, so it can be drawn over the notches to hold the top down securely.

MAKE MINIATURES From Your Favorite Portraits

Inserting the finished miniature transparency into a decorative, inexpensive metal frame for display.



Placing film in easel for making positive print by projection. Contact prints can be made if negative is large enough.



Toning the transparency often improves its appearance when mounted. The color chosen should harmonize with the backing.

One method of backing the picture is to paint it with metallic lacquer. The emulsion side usually is the one so treated.

by **JOHN DARWOOD**
Photographs by the Author

Photographic miniatures are as popular as ever. You can make them by treating transparencies in one of the ways described here.

MOST of us have admired framed photographic miniatures. The art of making these small positives, which seem to have a toned or metallic background, dates back several decades. Identical effects produced by more modern methods can be obtained easily by the average amateur today.

The attractive little photos consist essentially of miniature positive transparencies backed with some light-reflecting material such as gold, silver, or bronze paint, colored paper, or metallic lacquer. Because of the practically unlimited varieties of backing available, and the various colors the transparencies can be toned, there is virtually no end to the effects possible.

Select an attractive portrait or scenic negative for your miniature, preferably one having quite a bit of contrast and not too much fine detail. Make a positive print on a sheet of film or a glass plate. It is generally best to keep the size of the transparency small, say not more than 3¼ x 4¼". You can use a miniature frame, obtainable from a variety store, photographic dealer, or picture-framing house, as a guide.

Do not overexpose your positive transparency; and develop it fully, to produce a good, snappy image. The highlights should be nearly transparent, but the shadows can go all the way to black. When the transparency is dry you can test its appearance by laying it against a sheet of white paper. If the image appears too dark and flat when viewed thus, it can be improved by chemical reduction. Farmer's reducer is handy for this purpose, and the formula can be found in most photographic texts.

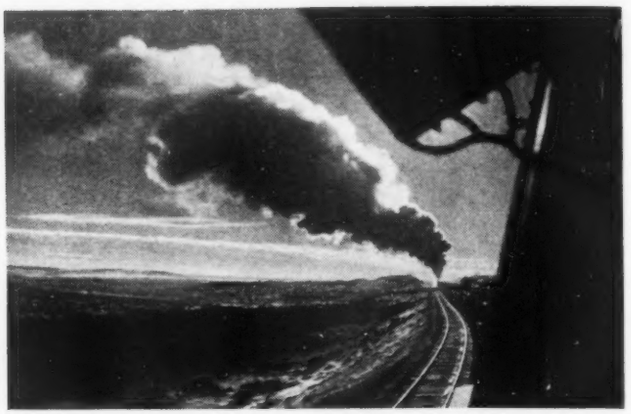
Almost any ordinary film can be used for the transparency. However, a panchromatic film has the disadvantage (since the single sheet of film must be carefully adjusted on the enlarging easel or in the printing frame) of having to be handled either in total darkness or by a very subdued green safelight. It will be found much more convenient to use commercial, process, or positive film or plates, or contrasty lantern-slide plates. If the negative is at all flat in quality, by all means use a high-contrast printing medium such as process film.

The transparency can be rendered more attractive in many cases by toning the image with one of the readily available color toners. Some discretion must be used here, since a sepia tone will look good against a silver background but may appear too flat against gold. If you run out of colors among the toners, try some of the photographic dyes and stains. When used with a relief film, such as Eastman Wash-Off Relief, these dyes offer interesting possibilities.

After the transparency has been washed and dried (and toned or dyed, if desired), it is ready for backing. One very effective backing method was used by commercial photographers 25 years ago in what was known as the Doretype process. Now virtually a lost art, this process consisted of backing a thin, small-sized, positive transparency with gold paint. Although a much wider assortment of backing materials now is available, the gilded transparency remains one of the most at-

(*Continued on page* 100)

For including dynamic action, human interest, and pictorial quality all in one print, we award this month's first prize to A. Himmelreich, of Tel-Aviv, Palestine. No technical data were available for this shot, due to existing conditions of communication.



Riding in the cupola of a caboose on a freight train in the Rocky Mountains, C. E. Roberts of Laramie, Wyo., took this picture shortly after sunrise. Exposure was 1/200 sec. at *f* 16.

Clare Leipnitz, Eau Claire, Wis., took this well-composed market study near Mexico City. An Ikoflex II, an A (red) filter, and Super-XX film were used.

PICTURES FROM OUR READERS

Warren Knoblock of Long Island City, N. Y., shot this Manhattan skyline study with the sun directly in back of the Empire State Building. His exposure with an Argus camera was 1/25 sec. at *f* 8 on Dupont Superior-3 pan film.

In photographing this old coach in Death Valley, Leo Anderson, Twin Falls, Idaho, used a yellow filter.

Using the rays from an ordinary flashlight, Donal Stole, Big Timber, Mont., took this picture with a Kodak Monitor camera. Exposure was 3 min. at *f* 16.

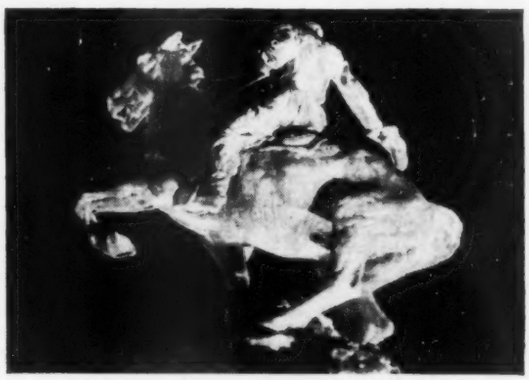
The Speed Graphic of C. E. Flynn, Champaign, Ill., caught this bit of action in 1/50 sec. at f 8 on Superpan Press.

The hurdling collie was photographed by Ernest Robson, Lafayette, Ill., at 1/550 sec., f 6.3. He used a Graflex.

2

Benjamin Agliano, Brooklyn, N. Y., wins second prize for this unique print. He took a negative of a piece of crosslighted leather, printed it together with the cowboy negative for a texture effect.

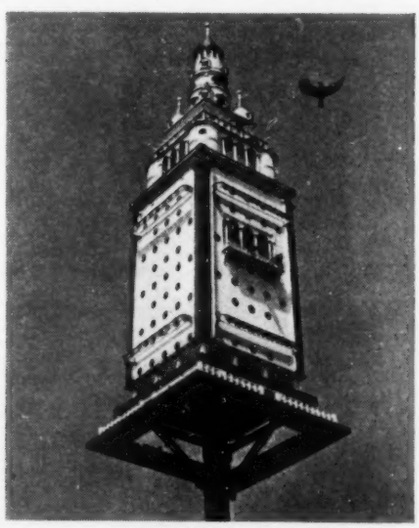
Seeing a cat prowling among some salmon cans, Lester Nase of Coopersburg, Pa., shot the amusing scene with an Argoflex. The exposure was 1/50 sec. at f 16.



Victor Ciomei, Chicago, Ill., made this Leica shot of a statue at night. His exposure was 1/2 sec. at f 2.

Good use was made of sky background and low camera angle in this informal portrait by William Pfeil of Allentown, Pa.

Effective crosslighting and a fast shutter speed helped make this shot successful. Submitted by W. W. Clinch, Burnaby, B. C.



Sanford Schultz, Ashtabula, O., took this photo with an exposure of 1/100 sec. at f 11, using a yellow filter and pan film.

TRADE NOTES AND NEWS

MANY OF THE light sources in the average darkroom or studio can be controlled from a single point by means of the new Princeton Photo Switchboard, it is said. The unit permits the photographer automatically to turn on one light and turn off another simultaneously, will serve as a high-low control for floodlights, and can be used to switch a spotlight on or off from camera position. It also makes possible the taking of several flash shots in quick succession, either with or without a synchronizer. Made by Price Industries Corp., 130 W. 17th St., New York City, the Photo Switchboard retails at $6.95.

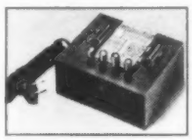


Photo Switchboard.

MOVIE MAKERS NOW can obtain two new 16 mm films from Fotoshop, Inc., 18 E. 42nd St., New York City. The first, Fotoshop Fine Grain Pan, is priced at $3.25 per 100-ft. roll; the second, Fotoshop Universal Ortho, sells for $2.95 per 100-ft. roll. Both prices include processing.

DESIGNED AS a supplement for daylight in home portraiture, the Black 3-15 Foto-Fluorescent lighting unit accommodates from three to five 15-watt fluorescent tubes. Among the component parts available in various combinations are tilting yoke, telescopic stand, reflector, and 3-, 4-, and 5-tube units. Prices can be obtained from M. Black Manufacturing Co., 300 N. Third St., Philadelphia, Pa.

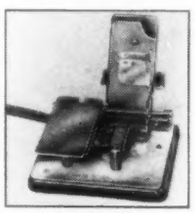
FITTED WITH A battery, electric bulb, and groundglass, the Minilum viewer is a vest-pocket accessory for viewing 2 x 2" Kodachrome slides. Priced at $1.50 complete, the viewer is distributed by the Weimet Co., 112 W. 44th St., New York City.

IT IS announced by the Olden Camera & Lens Co., 1265 Broadway, New York City, that purchasers of used cameras can obtain instruction books for the use of such equipment by sending 25c to Olden at the above address. The booklets are claimed to be identical with those furnished originally with the cameras.

A WETTING AGENT of high concentration, Kwik-Wet is for use in wash water, developing and fixing solutions, and various after-processing baths. It is sold in shaker-top bottles, each containing sufficient fluid for treating 75 pints of photographic solutions. Kwik-Wet sells for 35c a bottle, and is made by Mansfield Photo Research Labs., 701 S. LaSalle St., Chicago, Ill.

A NEW split-field, military type rangefinder is announced by Eastman Kodak Co., Rochester, N. Y. When viewed through the eyepiece of this accessory (known as the Kodak Service Rangefinder) the subject image is seen together with a pointer and a translucent range scale. Working at distances from 2 feet to infinity, the instrument retails at $5.75 with suede finish carrying pouch. Also announced from Rochester is the new Kodak Home Print Washer, which features a revolving drum and sells for $5. For more complete details on these items, write to Eastman.

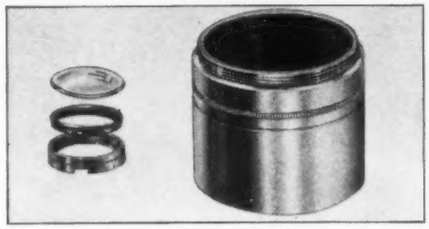
GROOVED CUTTING leaves to catch surplus film cement are one feature of the new Bool's Automatic Splicer for 8 mm, 9½ mm, or 16 mm film, according to the distributor, American Bolex Co. Inc., 155 E. 44th St., New York City. Made of steel, with a satin-chrome finish, the splicer also has a double-edged, spring-actuated file for scraping emulsion, and is mounted on a warp-proof ebony-finished wood base. For details regarding price and other features of the Bool's Splicer, write to American Bolex at the above address.



Bool's Splicer.

A NEW MODEL of the F-R Flash Synchronizer, employing an electro-mechanical principle of operation, has just been put on the market by Fink-Roselieve Co., Inc., 109 W. 64th St. New York City. Retailing at $8.95, the "electric" model can be distinguished from previous models by its red release button.

OWNERS OF cameras having a limited bellows draw or extension can increase the extension by means of Lafayette Extension Tubes and supplementary lenses. The lat-



Lafayette Lens, Adapter, and Extension Tube.

ter are available in three different powers, and in diameters from 25 to 39 mm, being priced from 59c to 98c each. The duralumin extension tubes come in various lengths for many makes of cameras, or can be made to order. Complete information regarding any of these accessories can be obtained from Lafayette Camera, 100 Sixth Ave., New York City.

BY WRITING to Eastern Camera Exchange, Hempstead, N. Y., readers can obtain copies of a booklet entitled "Camera Buyers' Manual." Eastern recently inaugurated a national mail-order division.

DEVELOPING A high-powered light output in a broad-peak flash of 110,000 lumen seconds, a new bulb known as Superflash No. 3X is announced by Wabash Photolamp Corp., 335 Carroll St., Brooklyn, N. Y. Designed for covering large areas in flash work, the new bulb has an absorption-free safety jacketing, and retails at 25c. More complete details can be obtained from Wabash.

PRICED AT 25c per 4-oz. bottle, Rosco Flexorine is designed to restore film to its original flexibility, and to preserve the emulsion and film base. It is made by the Rosco Laboratories, 367 Hudson Ave., Brooklyn, N. Y.

AMONG THE qualities claimed for Agfa's new Finex Developer for film are extreme fine grain, no loss in inherent film speed, and convenient ready-to-use liquid form. Finex is available in a specially packaged unit containing a 16-oz. bottle of developer, two 8-oz. bottles of replenisher, a graduate for measuring the latter, and a booklet on film processing. The kit is said to permit

(*Continued on page* 108)

CALENDAR OF PHOTOGRAPHIC EXHIBITIONS

SALON	ADDRESS INQUIRIES TO	ENTRY FEE	ENTRIES ALLOWED	CLOSING DATE	DATES OPEN TO THE PUBLIC
2nd Annual Cape Cod Salon of Photography, Photographic Society of Cape Cod	Salon Sec., Robert H. Boody, 479 Ocean St., Hyannis, Mass.	$1.00	4	July 19	Aug. 17—Aug. 24
2nd Annual North American Salon of Pictorial Photography	Salon Chairman, Grant Duggins, Sierra Camera Club, 1426 54th St., Sacramento, Calif.	$1.00	4 prints/ 6 col. tr.	Aug. 8	Aug. 29—Sept. 7
2nd Champlain Valley International Salon of Photography	Salon Secretary, c/o Robert Hull Fleming Museum, Burlington, Vt.	$1.00	4	Aug. 11	Aug. 24—Sept. 30
2nd Reading National Salon of Photography	R. W. Berhalter, Salon Chairman, 637 Court St., Reading, Pa.	$1.00	4	Aug. 25	Sept. 14—Oct. 5
Inter-American Photographic Salon, sponsored by Arlington Camera Club	Salon Committee, I-A. P. S., Hotel Twenty-Four Hundred Sixteenth St., Washington, D. C.	$1.00 Min.		Sept. 1	Oct.1 —Apr. 1
The London Salon of Photography—32nd Annual International	Hon. Secretary, London Salon of Photography, 26-27 Conduit St., New Bond St., London, W.1.	5s.		Sept. 3	Sept. 13—Oct. 11
4th Annual Tri-State National Salon of Photography, Burlington Camera Club	Robert B. Prugh, Salon Chairman, 317 N. Fourth St., Burlington, Ia.	$1.00	4	Sept. 20	Oct. 1—Oct. 16
16th Annual Salon of Photography, Museum of Fine Arts of Houston	Salon Jury, Museum of Fine Arts of Houston, Main and Montrose Blvd., Houston, Tex.	$1.00	4	Sept. 20	Oct. 4—Oct. 26
Victoria Photographic Association International Salon	Alec Gamon, Secretary, 468 Beach Drive, Victoria, B. C.	$1.00	4	Sept. 25	October
1941 International Salon of The Photographic Society of America	Photographic Society of America, 10 Park Ave., New York, N. Y.	$1.00	4	Sept. 29	Oct. 24—Nov. 22
3rd Annual Atlanta National Salon, Atlanta Camera Club	Mrs. Geo. Bird, Salon Secretary, 685 Morningside Drive, N.E., Atlanta, Ga.	$1.00	4	Oct. 1	Oct. 12—Oct. 31
Nature Salon of The Photographic Society of America	Salon Chairman, Russel Gray, 1530 Locust St., Philadelphia, Pa.	See Ent. Bl.		Oct. 1	Oct. 24—Oct. 26
1941 New York Salon of Photography, The Camera Club	Janet Weston, Secretary, The Camera Club, 121 West 68th St., New York, N. Y.			Oct. 3	Nov. 2—Nov. 30
6th Annual Cedar Rapids Salon of Photography, Cedar Rapids Camera Club	Wes Panek, Salon Secretary, 1910 Mt. Vernon Ave. S.E., Cedar Rapids, Ia.	$1.00	4	Oct. 4	Nov. 1—Nov. 11
West Virginia Annual Salon of Photography, Charleston Camera Club	Salon Committee, 110-A McFarland St., Charleston, W. Va.	$1.00	4	Oct. 11	Nov. 1—Nov. 9
Philadelphia International Salon of Photography, 1941	Salon Chairman, Hans Kaden, Architects' Bldg., 17th & Sansom St., Philadelphia, Pa.	$1.00	4	Oct. 15	Nov. 1—Nov. 30
4th International Springfield Salon of Photographic Art, Photo-Pictorialists of Springfield	Chas. H. Bolton, Salon Secretary, 117 Dunmoreland St., Springfield, Mass.	$1.00	4	Oct. 15	Nov. 2—Nov. 15
2nd Petroleum Industry Photographic Salon (Pictorial)	F. Quellmalz, Jr., Salon Director, Rm. 2040, 50 West 50th St., New York, N. Y.	....	4	Oct. 17	Nov. 1—Nov. 7
1st China International Salon of Photography, Photographic Society of Hong Kong	Hon. Salon Secretary, Room 117, Prince's Building, Hong Kong	5s.	4	Nov. 1	Dec. 1—Dec. 7

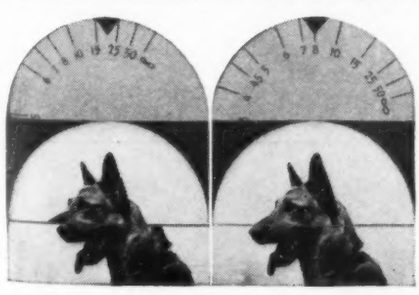
(Advertisement)

Kodak Bulletins

EASTMAN KODAK COMPANY • ROCHESTER, N. Y.

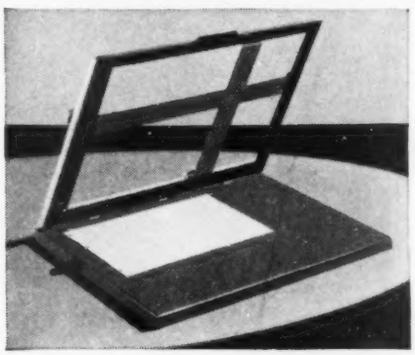
IT didn't take you users of roll and pack cameras long to find out for yourselves just what Kodak Plus-X would do for your all-round "pan" work. Within a few days of the time dealers first had stocks of the popular sizes, letters began coming in to Rochester. Enthusiastic first-time users wrote: "Used my first roll within an hour—developed it immediately—and the results were marvelous" . . . "just what I want" . . . "I like the quality I get" . . . "used four packs already and like its high speed" . . . "since I enlarge all of my shots, the fine grain is important to me" . . . "it's *my* film" . . . and so on. Plus-X is really a great film and its combination of high speed, fine grain, excellent gradation, and general photographic quality makes it particularly useful when you don't know just what's going to turn up next. For, unless the situation calls for the extreme speed of Kodak Super-XX—or you intend to make heroic enlargements, and need the microscopic grain of Kodak Panatomic-X—you are all set with Plus-X—it's "the film for your next picture."

IF you haven't a range finder—either on your camera or as an accessory—here's the convenient, accurate answer to focusing . . . the new Kodak Service Range Finder. It operates on the precise split-field triangulation principle of military finders and produces two clearly separated, brilliant images—easy to see, even when the illumination is not bright, and to bring into coincidence by turning the knurled knob. Its range is from 2 feet to infinity and there are two distance scales—one on the outside of the finder and the other inside, and appearing directly above the images as you look through the finder. Both scales show the distance to those parts of your subject that are in sharp focus. The two small illustrations show the subject as it appears through the finder—at left, when the subject is out of focus (in this case, the focus is beyond the subject) and at right, when the subject is in focus. The finder is finished in satin chrome, and is flanged on one end to fit into the universal accessory bracket of your camera. Complete with carrying pouch.

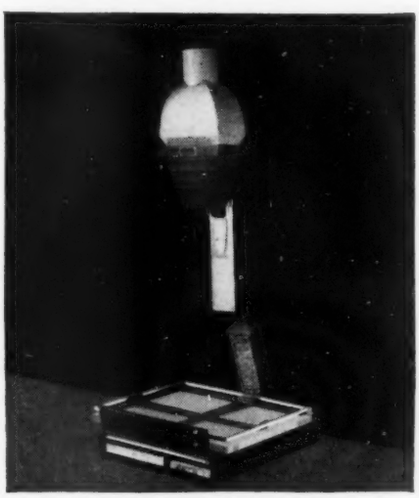


GOING from picture taking into your darkroom, here are several useful new products. First, the Brownie Darkroom Lamp, Model B. As shown in the illustration, it consists of a molded base which screws directly into any ordinary lamp socket, and into which are screwed three interchangeable threaded filter cups made of molded Tenite—Eastman's famous tough and durable plastic. The filter cups are Safelights Series 2, red, for handling orthochromatic films or plates; Series 3, green, for panchromatic materials; and Series 0, yellow, for papers. The cup-like design throws illumination over a wide field. Supplied complete with 7-watt bulb and any one of the three filter cups. Additional Safelight cups, available separately . . . set of all three with lamp and bulb in Brownie Darkroom Lamp Kit.

THE new Kodak 8 x 10 Metal Paper Board has several new features. It has a rigid, all-metal construction . . . fixed mask frames 8 x 10 paper to print size of 7½ x 9½ inches, with ¼-inch margin all around . . . two knob-locked, removable masking blades slide on calibrated scales . . . hinged masking frame has new toggle assembly which holds it in the raised position, shown, for positioning paper . . . and the paper stops are adjustable for top and left margins of from ¼ to ½ inch. The board is attractively finished in gray and has padded bottom to prevent scratching and movement.



BELOW—the new Kodak Auto-focus Enlarger, Model C, the simplest method of making fine enlargements from larger sizes of amateur negatives—up to 4 x 5 and 3¼ x 5½. There are two settings—one is auto-focus; a cam-and-lever arrangement keeps it in sharp focus throughout its range of from 1½ to 3½ diameters . . . the other is for manual focusing and makes possible greater magnification. The enlarger is illustrated below clamped on the accessory Kodak Enlarger Base (extra) which acts as a base and also provides convenient lighttight compartments for your papers. It can also be used clamped on the edge of a table or shelf—or on the accessory Kodak Wall Bracket (extra). Its illumination is a No. 213 Opal Photo-Enlarger Lamp, with elliptical section reflector. Special "dim-bright" switches, with ventilated resistor, are built into the upright. Supplied with Kodak Anastigmat lens, negative holder with set of 7 flexible metal masks, Kodak Masking Paper Board and lamp.



SEE YOUR KODAK DEALER

Print Criticisms

The service rendered on this page is free to our readers. Send your prints with technical data to POPULAR PHOTOGRAPHY, 608 S. Dearborn St., Chicago, Ill. We regret that we cannot criticize prints by mail. Send self-addressed and stamped envelope for return.

C. F., New Milford, N. J.—By taking this picture in a well-lighted room, you have achieved a balanced exposure. There is plenty of detail in the background.

Photo by C. F.

Left: Interest is concentrated by making the torch the main source of light in the picture.

and still the brilliant sparks of the torch are not overexposed. However, the effect of this picture would have been better if the exposure had not been quite so well balanced. If a darker corner of the room had been chosen as background in place of the light wall and windows, the sparks would have been emphasized more. Then, too, a longer exposure could have been used to permit the light of the torch to illuminate the faces of the workmen. This would have removed the somewhat distracting background elements, and would have given the subjects greater prominence. At the same time, the longer exposure also would have lengthened the bright trails of the sparks bouncing on the floor, putting more action into the picture. The background still can be darkened to some extent by printing it in under the enlarger to make the figures stand out.

* * *

R. C., Juniata, Pa.—Although your print indicates care in exposure and development, one thing was overlooked in planning this picture. It has no one subject that is clearly dominant. Neither the girl nor the flowers behind her stand out sufficiently. To make her the main subject, it would have been better to use a more simple background. The flowers could have been made the main subject by posing her at one side of the picture, looking at them or reaching out to pick them. As the picture stands now, the girl and the flowers clash. She is important because she is at the center of the picture and is looking out in the general direction of the camera. The flowers assume great prominence because of the splashy pattern their light colors make against the dark foliage. Whenever you find a picture setup like this, with two potential subjects, ask yourself which one you want to make dominant. Then use every trick at your command to make it stand out.

Photo by R. C.

* * *

A. P., Cincinnati, O.—You achieved an interesting portrait effect here by using a strong main light source and posing your subject against a black background. The dramatic effect of this lighting is very good, but it is weakened considerably by the secondary light which shines on the left side of her face. It would have been better to do without this light, or to move it farther away so that it would just barely lighten the shadows without creating a white area on the cheek and neck. As it is, it lessens the effect of the main light and, incidentally, makes the ear much too prominent. A second light could have been used to advantage if it had been placed above the subject at the right of the picture area, so that it would bring out a few highlights on the hair at the top and back of the head. This would have given the outline of the head, which usually is desirable, by providing a line of separation between it and the background. You can make it much easier to pick up highlights on the hair by applying a small amount of oil just before the picture is taken. The next time you photograph a subject with dark hair against a black background, shift your lights around until you get enough highlights to separate the head from the background.

Photo by A. P.

* * *

J. W., Ionia, Mich.—Your tabletop picture shows ingenious use of the airplane cutout, toy boat, and wrinkled cellophane. At first glance, the deception is quite complete, and it is only upon closer examination that the trick reveals itself. You could have made the photograph more convincing, however, if you had watched your lighting more carefully. The right wing of the plane is in deep shadow, which is quite unnatural up in the air when the sun is shining brightly. This is the first thing that raises doubts in the observer's mind. Then, upon closer study, he discovers that the plane is not lighted from the same direction as the water and the boat below it. Both these faults could have been overcome at the time you arranged the setup. The cutout should have been lighted evenly, so no shadows would show excepting those in the original photograph. The setup below it should have been lighted from the same angle as the original photograph of the plane. If everything in the picture had been lighted from the same angle, in this manner, the effect would have been that of outdoor sunlight—which would make the picture seem much more real.

Photo by J. W.

* * *

B. N., Madison, N. J.—There is much more good than bad in this picture. You did well to place your subjects in a spot of light to photograph them, for this makes them stand out against the dark background of the rest of the barn. Definite improvement would have resulted if the window through which the sunlight was streaming had been opened all the way. Notice the dark streaks running across the foreleg and head of the calf, and across the face of the cow. These probably are shadows of the frames around the window panes. They break up the picture and offer distractions—especially the long line across the calf's foreleg at the bottom of the picture. Whenever your subjects are part in sunlight and part in shadow, watch out for distracting shadows like these. It was a good idea to have the subjects in sunlight to concentrate interest on them, and the rest of the scene in shadow, but it would have been better to avoid these lines.

Photo by B. N.

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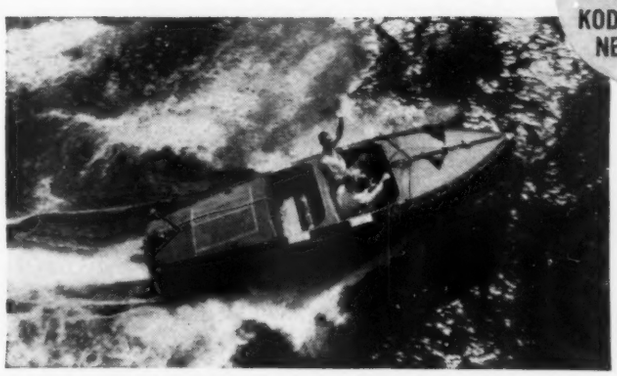

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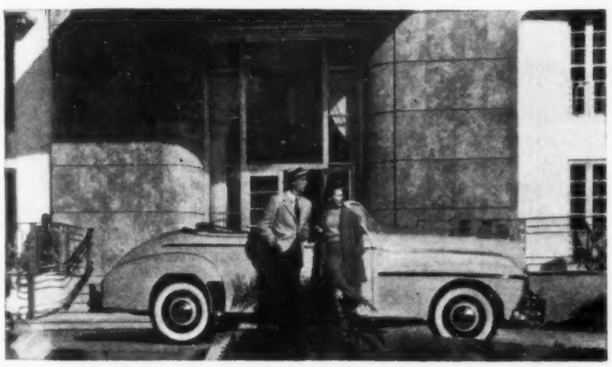

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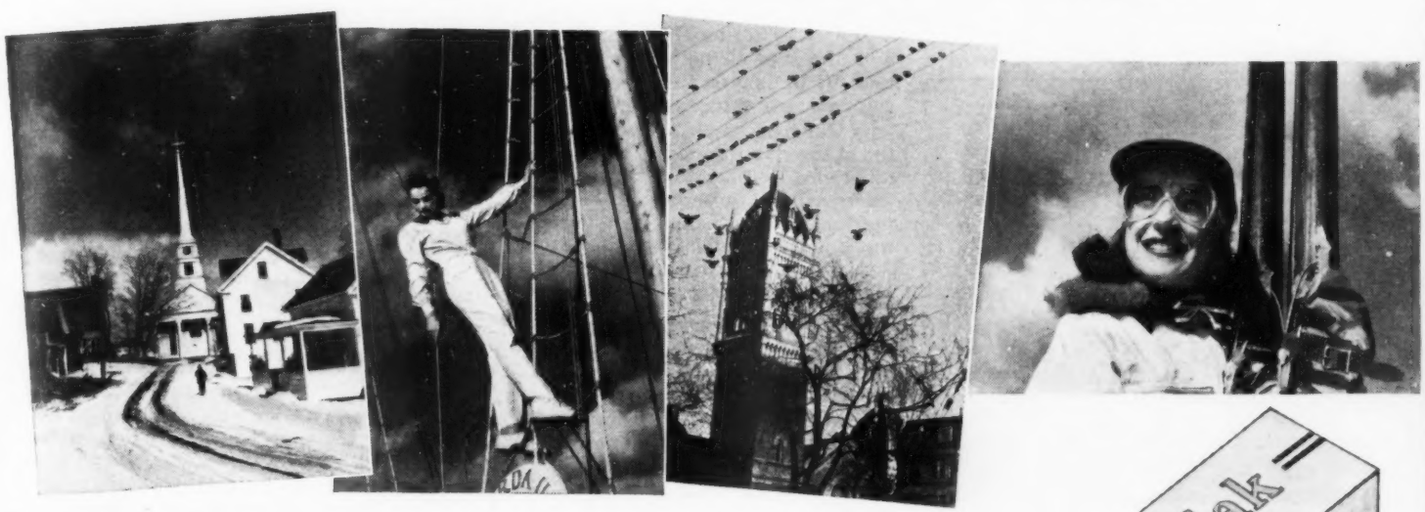

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New Tricks FOR CAMERA OWNERS...

A monthly list of valuable kinks and hints for the amateur. POPULAR PHOTOGRAPHY will pay $3.00 for each one accepted.

Keeping Solutions Cool

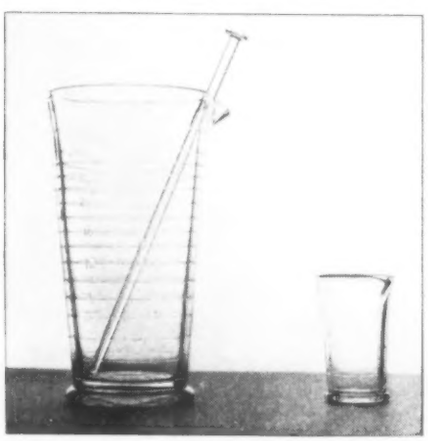
BY using a glass fruit jar filled with ice cubes, you can lower the temperature of your developer and hypo without diluting the solutions. Place the jar in the tray, and check the temperature from time to time as you work. It may be necessary to remove the jar of cubes after a few minutes to keep the temperature from dropping too low, but it can be set aside and returned to the developer when the temperature rises again. In extremely hot weather, faster results can be obtained by sprinkling salt over the ice cubes.—*E. White, Clifton, N. J.*

Cooling developer.

Photographing Glassware

SOME time or other, every photographer runs across the problem of taking a picture of glass. When this happens to you, you are in for quite a tussle with lights unless you have the benefit of a few technical hints.

To attempt lighting glass by methods that are conventional for other types of subject matter is to court disaster. You can struggle with the placement of lighting units for an hour before achieving a setup which eliminates reflections. And then you probably will find that the balance has been affected and it is time to start all over again. Notice the effective rendering of simple material in the illustration. The dark outline which appears along each edge is a characteristic phenomenon produced by this type of lighting. Here is how to get it.



Use reflected light for shots like this.

The glass articles are arranged on top of a table, preferably standing on a sheet of white cardboard. The table is placed about two feet from a plain wall. Just below the level of the table, set up a single light, *facing the wall*. In this instance, it happened to be a No. 2 flood in an aluminum reflector (clamped to one of the legs of the table). But that is not important. The one essential is to make the photograph using only reflected light.

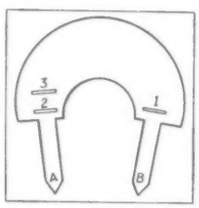
Arranging the setup is easy. Put your head in front of the camera and observe the setup. Move up and down, and you will find out quickly enough whether there are too many reflections falling on the lens.

There are other standard ways of photographing glass. One favorite method years ago was to fill the object with black ink to minimize reflections and get proper rendering of the outline. Putty has been used to dull the spots which pick up light. Polarization filters are another answer to the problem. But the method described above is the simplest of them all. It's practically fool-proof, and at the same time gives effective results.—*Sidney A. Diamond, New York, N. Y.*

Collapsible Lens Shade

HERE'S an idea for a collapsible lens shade you can make for yourself out of a section of old inner tube. It is easily adjustable to fit auxiliary lenses or to go on over filters and slip-on attachments.

Cut a piece of black inner tube as shown in the diagram. The inside semicircle should be slightly shorter than the circumference of your lens. Then slip point A through slit 1, and point B through slits 2 and 3. Put the shade on your lens, with the joint at the bottom, and draw it tight by pulling on the two points.



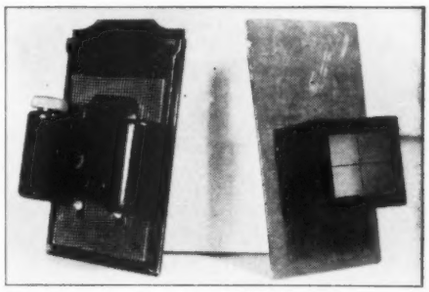
Shade opened.

If you are using a filter or a slip-on lens which is larger than your lens, put the shade on in the same way. The only difference will be that the ends of the shade will not quite join at the bottom of the lens. This makes no difference, as the lens is protected from glare from this direction by the bed of the camera.—*R. Martin, Chicago, Ill.*

Kodachrome Adapter

THE inexpensive Cub camera can be used to make a very satisfactory Bantam Kodachrome adapter for small cut film and filmpack cameras. Construction of the outfit is simple, although it cannot be done carelessly. First, the front of the small camera is sawed off at the point where it begins to taper toward the lens. File the edges smooth and square. Then place the camera face down on the center of the back of a filmholder and mark the size of the opening.

The easiest way to cut out this opening is to drill small holes all around on the inside of the line. After removing the center piece, file all the edges evenly. The camera back is fitted to the filmholder with small machine screws and tiny angle irons cut from the metal front of a discarded filmpack. The unit is made light-tight by sealing with strips of black cellulose tape.



The home-made adapter (left) and groundglass back employed with it for focusing.

In order to avoid cutting up another holder, the groundglass focusing screen can be built on a piece of 1/16" brass cut to the size of a holder so it will slide into the back of the camera. An opening is cut in the brass sheet of the same size and in the same place as the hole in the adapter holder. A rectangular wooden tube is made to hold the groundglass the same distance from the lens of the large camera as the film in the adapter. Accurate work is essential at this point, for the ground side of the glass must lie in exactly the same plane as the film in the adapter back. Measure the distance from lens to film carefully, and make the distance from lens to groundglass exactly the same.

Before you load up with color film, make a few test exposures at wide apertures with black-and-white film to make sure that your groundglass has been placed correctly. This adapter makes it possible to shoot color with your filmpack camera, using the Bantam Kodachrome film. Of course your regular lens will be of long focal length, but this merely will give a telephoto effect which is not at all undesirable, especially in portraiture.—*James W. Grant, Wilmington, Ohio.*

Avoiding Fingerprints

FINGERPRINTS on negatives are annoying and, except with the most careful handling, are almost unavoidable. This is especially true when centering a negative in a glassless negative carrier or under the mask of a printing frame. A simple aid in preventing fingerprints on your negatives is to wear rubber finger covers, such as those used by office workers, on the first finger and thumb of either hand. Use of these rubber finger covers allows the negative to be handled or moved by grasping it on any surface without any possibility of leaving a fingerprint. A pencil with a rubber eraser is a handy aid in adjusting a negative under the mask of a printing frame.—*Harold L. Bryant, Alexandria, Va.*

Placing negative.

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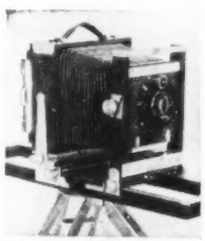
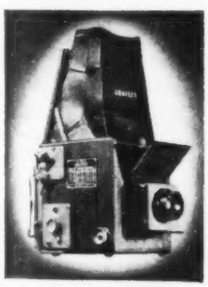


CROWN VIEW CAMERA



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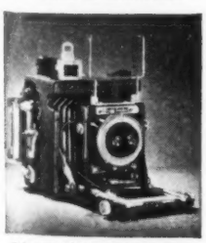

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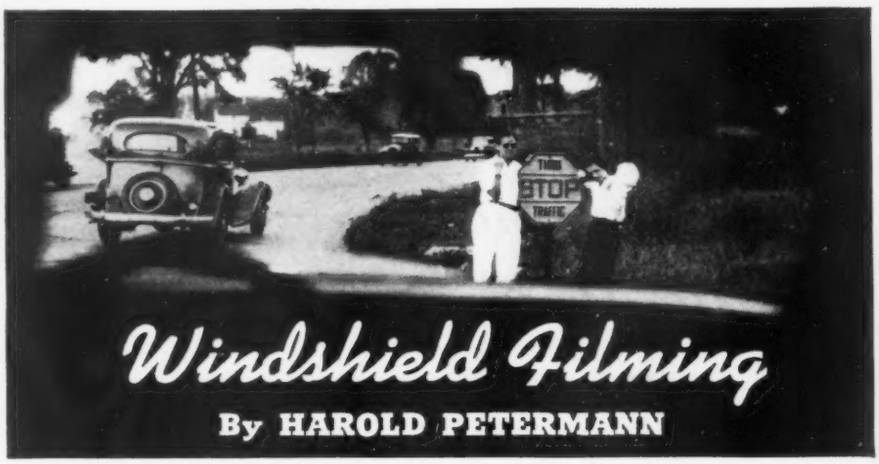
AMATEUR Movie Making



Windshield Filming

By HAROLD PETERMANN

THERE are lots of good vacation scenes that you can film without getting out of your car—or without even stopping, for that matter. If you keep your windshield clean, you can shoot right through the glass without any trouble. The motion of the car helps make such scenes more effective.

Usually it is best to take scenes of this sort at high camera speeds instead of the normal 16 frames per second. Otherwise the pictures are likely to be somewhat unsteady as they are projected on the screen, and the scenery is likely to fly past all too fast in the finished picture.

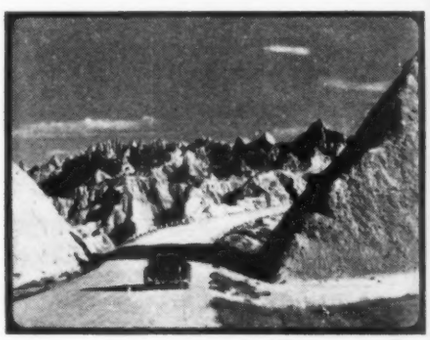
The movement of the car will be much less noticeable on the screen if you film such scenes at 24, 32, or 64 frames per second. Remember that the footage runs through the camera much faster at these speeds, and that the scenes will take longer to project than to expose. A scene taken at 32 frames lasts twice as long on the screen as it takes to expose it, if the projector is run at the standard rate of 16 frames. Don't forget to open up your lens to compensate for the increased shutter speed.

If you are following a road that you have traveled before, it is an easy matter to plan ahead for the scenes you want to get and be ready to shoot as you approach them. On a highway that is new to you, you will have to watch ahead for attractive scenes you want to film.

The best spot in a car from which to take pictures on the road is beside the driver. By holding the camera near the windshield, you can avoid showing any of the frame around the glass. The front of the hood and the radiator cap are likely to appear in many of your scenes, however, unless you are able to catch the view you want by tilting the camera upward.

An interesting effect can be obtained by shooting from a back seat, framing the view in the windshield of the car. Although this cannot be done with all scenes, it makes an interesting variation once in a while.

Don't limit your filming along the highway to things you can get from the seat



This is a typical scene caught from a car.

of a car. When you see something that interests you and can't be caught from the road, stop and get it. But don't neglect the many good shots you can take through the windshield with the car in motion.

Intelligent Panning

ONE of the most common faults in amateur movie making is an excessive use of the panorama. It is generally preferable to avoid moving the camera while making a shot, but this does not mean that the pan is entirely excluded. It can be used effectively where there is good reason for it, if a few simple rules are observed.

To begin with, pan slowly. If you don't, the picture becomes a series of streaks which are completely useless, except as a means of annoying the audience. Allow time for the observer to look at each part of the view as it moves across the screen.

Second, make the pan at a constant rate of speed. It should be smooth and even. A tripod with a tilting and rotating top will help you avoid jerkiness. Remember,

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AMATEUR Movie Making

(*Continued from page 72*)

in the third place, to pan only in one direction. It may be up, down, or sideways, but don't make the mistake of retracing your steps. No point in the scene should appear *twice* in the same shot.

The main reason behind these restrictions is simply to save wear and tear on the fellow who is watching the picture. If you wave the camera around like a garden hose, the resulting film is bound to be difficult for your audience to follow.

All of this is subject to one important exception. When following action, the rules are off. The idea in this case is to keep the moving figure in your viewfinder, because that's what the audience wants to see. The ideal spot for the subject is just behind the center of the frame. Leave a little more space in front of the moving figure than after it. Otherwise, the shot will give the impression that the subject is having a race with the camera. Your audience may get the feeling that he might win, and run out of the picture altogether.—*Sidney A. Diamond, New York, N. Y.*

Making Book Titles

THE book title has been used for years by Hollywood, but it is equally adaptable to the needs of the home movie maker. It presents an opportunity for you to use a little ingenuity and make smooth transitions from one title to another without the use of fades, wipes, or dissolves. The most convenient method of book titling is to build a book to fit the needs of the movie you are editing.

This book gives a fine title presentation.

In most cases it is difficult to adapt and disguise a printed and bound publication, and it is best to start with sheets of cardboard or paper of the proper size, draw or mount the desired titles, and then stitch them into the final book form. The accompanying photograph shows one such title book that was made to fit into a film showing the activities of children in school. The sheets were 14 x 17", and a series of sketches were drawn on them with center spaces for mounting photographs or sections of black paper on

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AMATEUR Movie Making

(*Continued from page 74*)

which the wording had been printed. Only one side of each sheet was used.

The next step was to cement strips of binding cloth at the ends of the boards, using two strips—one on each side for strength and flexibility. The boards were assembled then, in order, and the whole thing stapled together with an ordinary desk stapler. The last step was to cement a fold of binding cloth around the back edge to conceal the stitching job.

The entire series of main titles is bound together—main title, photograph illustrating the theme, credit titles, and end.

Once you make up your title book, you can film it in many ways. One amateur film shows the title book on a table. Single-frame photography is used to show the pages of the book opening and turning without human assistance. Another places the title book in the hands of an actor and shoots over the actor's shoulder as the pages of the book are turned. In one amateur movie, a clever transition between introductory titles and action was made by shooting the pages of the title book as an attractive youngster turned them. Following the last of the introductory titles, the film-maker had placed another page bearing a photograph. The child fell asleep, and the film dissolved into the actual scene just shown in the still photo. At the end of the film a dissolve brought the audience back to the youngster still asleep over the book. He awakened, then turned to the next page in the book, which read, "The End." —*Godfrey Elliott, Oakvale, W. Va.*

Temporary Film Splice

THOSE embarrassing interruptions that sometimes come in your best films when there is a break during projection can be overcome quickly if you keep a roll of cellulose tape handy. Tear off a small piece of tape and splice your film together with it, placing it on the shiny side. Make sure the tape clears the perforations. This will only take a second and the temporary splice will permit your show to continue more quickly than if you took the time to make a regular splice. You will find that the tape will not harm the film. After the show you can make proper repairs. Several pieces of tape, cut the exact width of your film (clearing perforations) can be kept on hand for each performance.—*Walter Masson, Boston, Mass.*

Shooting Extra Frames

IT is poor economy to make your movie scenes too short. You always can cut, but you can't add frames that haven't been taken. It is a good idea to plan in advance for a few extra frames at each end of a shot. Perhaps you will feel better about the slight additional expense when you learn that the average Hollywood movie as it comes to your local theater uses only about 10 per cent of the footage shot in its production.—

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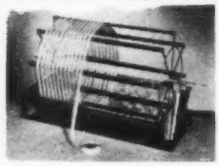

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(Continued on page 79)

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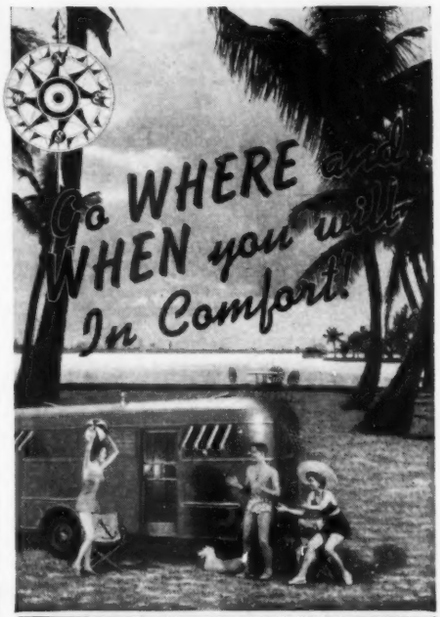

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On "the River"

(*Continued from page 25*)

largely a matter of choosing the best angles. Choice of angle depends, of course, on the purpose to which you put your pictures. The purely pictorial angle will not always be the one which will sell first to a barge line company. This matter of angle is up to the individual photographer—his available opportunities and his purpose in making pictures. The three best possibilities are shooting from bridges, from locks and the lockmaster's station house, and from the decks of other boats. You will have little luck trying to shoot from the bank, for the Mississippi is so wide that only a telephoto lens will bring the boats to any size on the negative.

Shots made from bridges will best fit the needs of the photographer who hopes to market his pictures with barge companies or other commercial sources. They have many pictorial possibilities, too. The only trouble is that they are likely to be monotonous, and there is difficulty in keeping them from becoming cluttered with obstructing traffic in the background.

Shots made from locks and lock stations suffer the same danger of becoming monotonous because of constant similarity of angle. Of course there are no locks and dams on the Lower Mississippi (that is, below Cairo, Ill.).

The best chance for varying angle and scenic background in photographing river boats is to shoot from the deck of a vessel. Depending on the size of the boat, you have a limited choice of angles on the deck itself—and there is the added opportunity of framing your picture with some part of the boat you are on. Pictures made from boats may carry decks as foreground material, ropes and stages, a part of the paddlewheel, or the spray and wake. Such interesting "framing props" add color to pictures which might otherwise be dull.

The angle will be influenced, too, by the kind of boat you are photographing. The high angle is almost essential to show a big tow of barges—otherwise you will include only the blunt nose of the first barge and nothing at all of the eight or ten which lie behind it. A broadside view of a big tow—even if you *could* get such an expanse into your viewfinder—is a poor photograph.

For the paddlewheel towboats and the packets, three-quarter stern views are best. They picture the fine surging spray of the turning paddlewheel, and are effective whether the boats are photographed from a low or a high angle.

Of course, there is the obvious angle of shooting straight ahead from the hurricane deck or the pilot house of your own boat. A better spot still is on top of your own pilot house. This gives you the necessary height and the opportunity of three good shots of the oncoming boat —a head-on front shot, a broadside view, and a view of the stern of the boat as it passes on down the river. When you choose this perch for your shooting, however, you usually eliminate the possibili-

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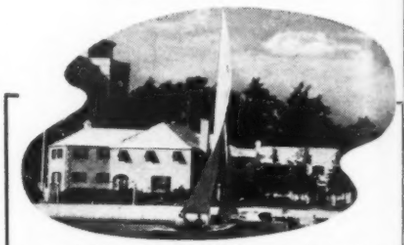

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Excursion boats themselves make good pictures. A particularly effective shot is that of the excursion boat tied up at night—its lights glowing brilliantly out of the black night on the river.

There are only two passenger packets left on the Mississippi—the *Golden Eagle* out of St. Louis and the *Gordon C. Greene* out of Cincinnati. The *Gordon C. Greene* actually operates on the Ohio, and makes only one trip a year on the Mississippi—down to New Orleans' Mardi Gras in February for a three weeks' trip. The *Golden Eagle* makes trips on the Upper Mississippi from St. Louis to St. Paul, Minn., and from St. Louis down to Cairo, Ill.—as well as on the Tennessee, Cumberland, and Ohio Rivers. Passage on either of these boats will provide you with opportunities to make practically all the pictures offered by the river and river life.

Passage aboard the towboats is practically impossible to secure, since there is a government regulation preventing their taking passengers. However, if you live along the river and have friends who own river boats, there may be ways by which you can manage a trip.

There are a countless variety of shots available—beside those of other boats—to the passenger on a packet or towboat.

On the Upper Mississippi, the new chain of government locks offers rich material. "Locking through" one of the big government dams is one of the most interesting bits of navigation available to river travelers. Each lock is a new experience. From pilot house to barge deck on the big tows, and to the front "stage" of the packets, there is a throbbing excitement in the air. The big tows often have only a foot or two of clearage in the locks. To work his million-dollar tow into this narrow berth, against the bucking river currents, is a job which makes many a pilot's hair turn gray! Down on the barges the deckmen and roustabouts have their own ticklish jobs—to swing the heavy lines around the winches at just the right time, and to hold them fast until the exact moment to release them. All this is thrilling to watch, and more thrilling to photograph.

Another procedure in river navigation is "throwing the lead"—that practice from which young Sam Clemens took his name, "Mark Twain." It is done today in the same way as in Mark Twain's time, and it makes a good picture for your river collection. Catch the weight in the air as it is thrown to take a sounding.

The whole hurried, anxious business of "taking on a tow" for the big towboats offers interesting picture possibilities. The skill the deckmen show in handling the long barges, tightening, loosening, and retightening the countless heavy lines which tie the barges together, is amazing and thrilling—worthy of a picture series which has never yet been made.

On the packet boats there are even more possibilities. "Making a landing," when the packet swings in the midst of the stream and heads for the shore, then lets herself be tied up by heavy lines that hold her against the pulling current—this is repeated whenever the packets stop on their long, leisurely cruises at the ghost river towns along the way.

From the decks of the packets, too, there are opportunities to catch pictures of life along the river. Small boats pass endlessly. Fishermen work at their nets from their bouncing skiffs. Light keepers are busy replenishing the oil in the river lamps, which must never go out.

The pictorialist and landscape photographer will not need to be told of the wealth of material offered him by Ol' Man River. If he lives anywhere near the Mississippi, he doubtless already has spent hours and days scrambling along its shores or climbing the bordering hills.

The hills that bank the Upper Mississippi offer magnificent scenic views. Along the Lower River such opportunities are rarer—the shores flatten out into dull sand banks, willow-covered and wild. But in both regions there are certain spots, if the photographer will take the trouble to find them, that will reward him with spectacular views different from any others in the world.

The broad stretches of the river are beautiful in all kinds of weather. There are brilliant, colorful dawns. Sunbursts break through storm clouds to light the moving currents. Sunsets catch highlights in the wake of the chugging stern-wheelers. Mists and fog move their somber curtains along the winding stream.

Included among the purely pictorial subjects are the discarded old paddle-wheels, and the steamboat wrecks which occasionally stick their bones out of shoal waters or lie bleached and rotting along the levees. These pictures carry a heavy dramatic appeal.

River people are a race apart. They have their own traditions, their own customs, and their own individual personalities.

Nowhere in America is there a more colorful group of men than the old Mississippi River pilots. Some who sit at the chromium-plated steering levers of the streamlined towboats have piloted every type of boat the river has known. They are, without exception, full of a mighty zest for living—and full of tall, bold yarns gathered from years of river life.

The pilot houses on most of the smaller river boats fulfill all the requirements of background for photographing these characters. The huge steering wheel is still in its place, whether it is actually used or not. So are the ropes that pull the bells in the engine room. But the pilot house of a diesel-powered towboat is a disturbingly modern affair. If you want your pilot to look the part, you'll have to have him dig up a cap and stand

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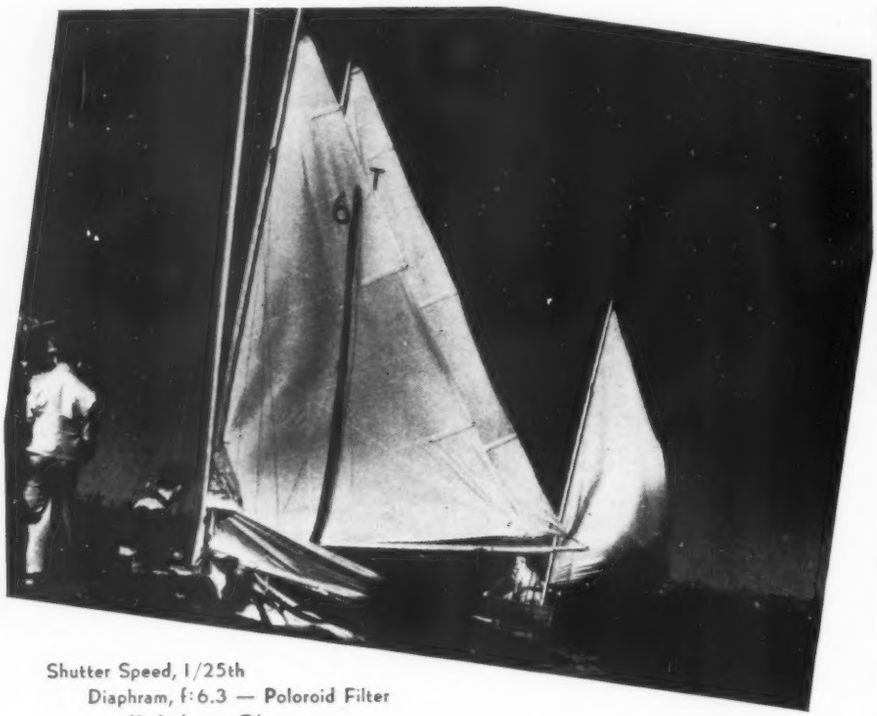

Shutter Speed, 1/25th
Diaphram, f:6.3 — Poloroid Filter
Kodachrome Film

down on the hurricane deck with the pilot house for a background.

The engineer also is a character of distinction, and if you will only photograph his beloved engine and send him a print, he will pose as long as Ol' Man River keeps rollin' along.

On the smaller boats, Negro roustabouts as interesting as those of Mark Twain's time still load cargo from the levees. They are as flavorsome a lot as their forebears, and furnish all kinds of picture material as they go about their work or loll lazily on the "head" of the foredeck.

Shantyboat people you will find, but not in abundance. Not on the Big River, but in the mouths of the smaller streams, does this breed have its habitation. They are a reserved lot of people, and not very amenable to photographers. If you can get them to pose, however, they make good character studies.

Don't antagonize shanty folk or other unwilling subjects. A telephoto lens is helpful in photographing people unobserved, and will be found useful in other ways as well.

No one camera can be recommended for covering the river. The Graflex is excellent for shooting river boats from the decks of other boats. The Speed Graphic is almost equally good. Long focus lenses or supplementary lenses are splendid for this kind of work. The larger miniatures make good cameras for most of the material discussed in this article. The 2¼x2¼ twin-lens reflex is particularly adaptable, since it is light, small, and easily handled in the rush that is so often a part of river work.

If you can use fast film without overexposing, we recommend it. The additional depth of field that you will get by stopping down with high-speed film will be an advantage.

The greatest difficulty encountered by river photographers is overexposure. Water reflects the light, and there is such a great expanse of sky and water that overexposure is an all-too-natural result. Use a light meter, by all means, but use it correctly—don't just point it vaguely out somewhere on the horizon line. Take a reading on the water fairly close to your own boat. Use your meter intelligently, or it will be more of a hindrance than a help. If possible, check on your exposure by having some films developed early in your trip.

Take a filter, because you can expect spectacular cloud formations. You also will need it to get proper rendition of the water. Use a lens shade, by all means, to avoid reflections from the water and from "brasses" on the boats.

In shooting from a boat, you will have to use a fast shutter speed. The vibration on river boats is very bad. Do not try to shoot below 1/100 second. A safer speed is 1/250.

The river offers all sorts of possibilities. Once you feel the deck of a river boat under your feet and begin to look around you, you will see chances to make many shots that tell the story of the Mississippi. If you get a chance this summer, try taking pictures on the river. The results will make your excursion a trip you will never forget.—

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BY using an old reflector clamp, you can make an excellent magnifying glass holder for retouching. Merely loosen the clamp screw and remove the reflector. Then file a notch in each of the flanges to fit the metal clamp that holds the magnifying glass, as shown in the accompanying photograph. The clamp screw then is tightened to hold the glass firmly in place. Because of the rubber grips with which the reflector clamp is equipped, it can be fastened to any steady object readily. The joint with which it is equipped makes it easy to turn in any direction. If you don't have a discarded clamp, one from your regular reflectors will do. It can easily be switched back and forth from glass to reflector as needed.—*Clyde B. Ragsdale, Lamesa, Texas.*

Adjustable holder.

Roughing It

(*Continued from page 26*)

tree, tripod, or firm substitute. The spring to actuate the camera shutter at the proper moment is a small, flexible twig, fastened to the support alongside the camera. It is then bent toward the shutter release until it has sufficient tension to trip the shutter if it is allowed to spring back. At this point it is attached to the shutter release by means of a short length of twine, looped over the camera trigger at one end and tied to the bent twig at the other. A second piece of twine, tied to the same point on the twig, secures it in the bent position. You now have a tensed "spring" attached to your camera release, ready to trip the shutter as soon as the second cord, which holds it, is severed. To this cord attach a length of dry grass and light the end of it with a match. Then run and pose.

The flame will crawl up the blade of grass, burn through the cord, and release the twig, which will spring out and trip the shutter.

A similar principle can be employed to set a camera trap for taking pictures of wild animals. Instead of using a burning fuse, the tension retainer cord is attached to a small twig which is carefully wedged under a hooked stake in the ground. A long cord attached to this twig runs along the ground to the point upon which the camera is focused, where it rests with a piece of bait tied to it.

Then, when an unwary animal pulls at the bait, he dislodges the twig from the hooked stake where it has been delicately wedged. Thus the released spring twig trips the shutter, bagging a picture of the unsuspecting animal.

These are but a few of the accessories that nature abounds in. Next time you're out in the woods and realize you lack some special piece of equipment, just look around and whittle yourself a suitable substitute from the materials at hand.—

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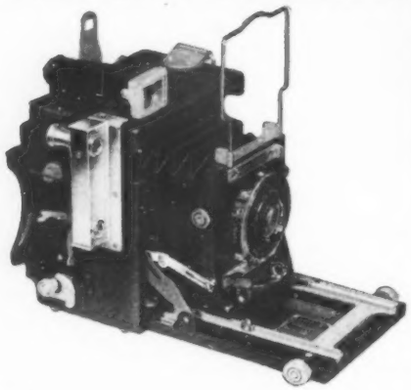

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PRESS FLASHES

By FRANK J. GILLOON

WHILE the country at large was worrying over the possible loss of American lives when the *Zamzam* was sunk by a German sea raider recently, cameramen were rejoicing over the good fortune of Dave Scherman, staff cameraman of *Life* magazine, who was aboard as a passenger enroute to an assignment. To the best of our knowledge this is the first time a professional cameraman ever had such an opportunity. We can be sure Scherman made the most of it.

• • •

THE Kentucky Derby of 1941 is now history, but for some of the cameramen who take pride in their knowledge of horseflesh it holds not-too-dear memories. If some of the horses on which they had bet moved as fast as the cameramen did in getting their pictures, everything would have come out all right. While some lensmen still were traveling on slim rations as the result of wrong selections, Sam Falk and Arthur Brower of *Wide World* split $800.00 on a two-dollar ticket daily double at Belmont Park a few days after the Derby. Sam let Brower pick the horses for the very sane reason that young Arty had never visited a race track before and had never bet on a horse. Part of Brower's winnings went for a bassinette.

• • •

THOSE, like us, who have to make out minute reports on the use of film and bulbs, will be amused by the report that we found an amateur who actually owns two Speedray outfits which he uses exclusively in photographing his grandchildren. (Auditing departments, please copy.)

• • •

IT HAS been a real pleasure to note each month the formation of new cameramen's associations, the object of which is to obtain better working conditions for news photographers while on assignments and to bring members of the profession together more often in a social way. These associations now in existence in practically every part of the United States are recognized by federal, state and civil authorities; by promoters of amateur and professional sports, and those in charge of special events that call for picture coverage.

Photographers are now accepted on equal footing with reporters in the very best of places. In fact, even a cub reporter will stoop to speak to a cameraman these days—and that is a real concession. However, there are still some die-hards. Though they crave photographic publicity, they still look down their noses at cameramen. The officers of the various associations no doubt can educate these people to cooperate as time goes on.

Tennis and golf tournaments are now being played all over the country, and the football season will be on us before we realize it. We suggest that the different associations discuss among themselves the places where proper facilities are not made available to cameramen, so a committee can take the matter up with the authorities well in advance. Often a lack of notice of the photographer's requirements has been the cause of poor working conditions on a story. Let us cooperate with those from whom we are seeking cooperation by having a business-like discussion about conditions in sufficient time to have proper credentials, special stands, and sufficient policing arranged for.

• • •

RUDOLPH VETTER of *Acme's* New York office resigned to enter the Signal Corps as a photographer. Jack Simon, *Wide World* desk man, is now at Fort Bragg with a corporal's rating after six weeks of training. Ace Rosner, *Wide World* man in Baltimore, also is wearing a uniform. His last assignment before leaving for camp was to photograph Ola Elizabeth Winslow, winner of a Pulitzer award for her book, "Jonathan Edwards." After receiving the assignment from his New York office, Rosner hot-footed over to the lady's home, but he had to await her return from a faculty meeting. When he asked her to pose, she regarded the whole thing as a huge joke and refused to grant any pictures. While he was still trying to convince her that she was now a famous woman, a telegram arrived from the Pulitzer committee, advising her of their selection of her book. Then he got the pictures he wanted. Rosner was hours ahead with his shots.

• • •

CHARLIE CORTE has been transferred from the New York office of *Acme* to the Cleveland bureau to replace Larry Gahn as cameraman under Bob Donohue, bureau manager. Dave Wurzel, a cousin of Joe Wurzel, London manager of the *Associated Press* picture bureau, has been promoted to the staff to replace Corte. Harry Liederlandler, formerly of *A.P.*, also has joined the New York *Acme* staff.

• • •

DALE ROOKS, former news cameraman who directs Kent State University's well-known short course in news photography, is back toting a camera again during his long summer vacation. He is taking pictures in Wisconsin and Upper Michigan for the roto section of the Milwaukee *Journal*.—

FLASH! 575 AMATEURS TEST CHEWING GUM

Michael Mulryan, amateur photographer, was among those who took the Beech-Nut taste-test.

The yellow package with the red oval . . . with the preferred flavor

2 out of 3 preferred the flavor of Beech-Nut Gum

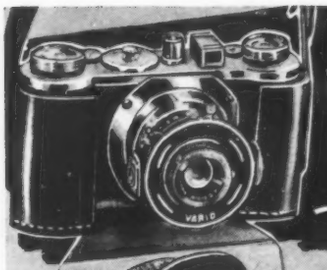
The delicious flavor of Beech-Nut Gum is preferred by **387** out of **575** amateur photographers according to a recent taste-test made by an independent fact-finding organization.

For the test, various brands of chewing gum of the same flavor were bought in local stores and identifying wrappers were removed. Each amateur was given two different brands (Beech-Nut and one other, both unidentified) and was asked to report which stick he preferred. **2** out **3** said that they preferred the flavor of Beech-Nut to that of the other brand.

Try a package of Beech-Nut Gum yourself. See if its delightful flavor doesn't click with you, too.

Another prize-winner—BEECHIES—delicious pieces of Beech-Nut candy-coated gum. Peppermint, Spearmint, Pepsin or Cinnamon.

Beech-Nut Gum



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Type D — (takes 51mm filters) To fit lenses 51mm diameter **2.98**

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25mm ..... **84c** 39mm **1.19**
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HOW TO ORDER
1—Measure outside *diameter* of lens barrel with millimeter scale. Give this size and whether you want holder, shade or combination.
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CAMERA CLUBS

Additions to the Roster

Already having grown to an imposing list of several thousand clubs, the registry of organized photographic groups continues to increase each month. As the names and addresses are received they are passed along to readers of this column in an effort to stimulate the interchange of correspondence and ideas among old and new clubs alike. Here's the latest group of registrants:

Century Camera Club, % Walter Schumacher, 301 Beechfield Ave., Baltimore, Md.

Donora Camera Club, Margaret G. Brown, Sec., Herald-American Building, Donora, Pa.

Shreveport Camera Club, Robert M. Trimble, Sec., Box 1202, Shreveport, La.

Women's Photographic Club of Columbus, Florence MacMillan, Pres., 2260 Indianola Ave., Columbus, O.

Victoria Photographic Association, Alec Gammon, Sec., 468 Beach Drive, Victoria, B. C.

Walla Walla Camera Club, R. W. Heater, Sec., 552 E. Maple St., Walla Walla, Wash.

Mount Helena Camera Club, W. M. Hughes, Vice-Pres., Helena, Mont.

Viewfinders of Miami, John P. Greene, Jr., Sec., 726 N.W. 22nd Court, Miami, Fla.

Kwick Kamera Klique, Roberta Garber, Pres., Hesston College, Hesston, Kan.

R.U.H.S. Camera Club, % Richard Johnsen, Jr., 540 Twelfth St., Richmond, Calif.

Valley City Camera Club, Jack Baker, Sec., 183 King St., W., Dundas, Ont.

Grand Island Travel and Camera Club, Mrs. J. G. Lofgren, Sec., 403 S. Kimball St., Grand Island, Neb.

Egyptian Camera Club, E. L. Culbreth, Jr., Pres., 810 E. Third St., Centralia, Ill.

Clarksdale Camera Club, % William K. Love, Jr., Box 225, Clarksdale, Miss.

City Bank Camera Club, % E. Purcell, City Bank Farmers Trust Co., 22 William St., New York City.

Saco & Biddeford Camera Club, P.O. Box 184, Saco, Me.

Buchtel High Camera Club, % Harry Goodman, Buchtel High School, 1040 Colpey Rd., Akron, O.

Cisco Camera Club, Earl Walker, Sec.-Treas., General Office, Carnegie-Illinois Steel Corp., Youngstown, O.

Syracuse Movie Makers Association, Bernhardt E. Rightmyre, Sec., Box 1360, Syracuse, N. Y.

Haverhill Camera Club, Pasquale A. Lanza, Sec.-Treas., 66 Portland St., Haverhill, Mass.

Two More Councils Organize

Making use of a time-tested formula for success, clubs in two more localities have banded together into councils with an eye toward stronger and more unified efforts. The Tri-City Federation of Camera Clubs is interested in receiving any suggestions for programs and other activities, and includes the Moline Photographic Society, The Black Hawk Camera Club, The Rock Island Camera Club, The Moline Turners Camera Club, and the Farmall Photographic Society. Correspondence for the Tri-City group should be addressed to James R. Bridge, 2105½ Claussen St., Davenport, Ia.

The Rochester Council of Camera Clubs came into being at a recent meeting in Memorial Art Gallery, Rochester, N. Y. Clubs already represented in the council are the Amateur Photographers Club, Graflex Camera Club, Genessee Camera Club, JYMA Camera Club, Kodak Camera Club, Raytar Camera Club, Photo-Tech Camera Club, and Rochester Camera Club. Organizations anywhere in the Rochester district are invited to affiliate with this council, of which the secretary-treasurer is Harvey Morris, 142 Vassar St., Rochester, N. Y.

News of Club Salon Exchanges

The Shreveport Camera Club has collected 25 prints from its 1940 salon, which it wishes to exchange with other clubs, according to Robert M. Trimble, club secretary, 405 City Bank Bldg., Shreveport, La.

The traveling exhibit of the Donora Camera Club will be available for loan or exchange after July 15, according to club secretary Margaret G. Brown, Herald-American Bldg., Donora, Pa.

Correspondence regarding the exchange of prints and shows will be welcomed by the Century Camera Club, Walter Schumacher, print chairman, 301 Beechfield Ave., Baltimore, Md.

Mount Helena Camera Club, Helena,

Mont., is anxious to exchange club shows, according to W. M. Hughes, club vice-president.

Amateur movie clubs will be interested to know that the 8-16 Movie Club of Philadelphia has prepared some club films for exchange with similar groups of fans. In this connection write to George Burnwood, 7019 Hegerman St., Philadelphia, Pa.

Army Regiment Forms Club

Photographic enthusiasts now in service with the 131st Infantry Regiment of the United States Army, now stationed at Camp Forrest, Tenn., recently met and organized the 131st Infantry Camera Club. Under the supervision of regimental officers, it is hoped that the club will make processing facilities available to men who have thus far curtailed their photographic activities to some extent since going to camp.

Chicago Club Announces Its Third Annual Salon for Amateurs

Open to amateurs only, the third annual salon held by the Lens Camera Club of Chicago has been announced, with August 21 being the final date for entries. Selected prints will be displayed from September 7 to October 1, inclusive. Medals and honorable mentions will be awarded, and each entrant can send in a maximum of 6 prints. For further details on this show, write to the print chairman, Miss Mabel McCullough, 423 E. 60th St., Chicago, Ill.

We Hear . . .

THAT *Walla Walla C.C.* has successfully requested 25 feet of wall space for the purpose of displaying members' salon prints during the Walla Walla County Fair out in Washington this September. Pretty quick work for a club which only started meeting a few months ago.

On the second birthday of the *Women's Photographic Club of Columbus* (O.) we offer hearty congratulations. The ladies have accomplished much in a couple of years. Incidentally, they'd like to swap correspondence with other groups of woman photogs. . . . Another anniversary well worth noting was celebrated late in June by the *Lens Club of Bayonne* (N. J.) at its third annual dinner.

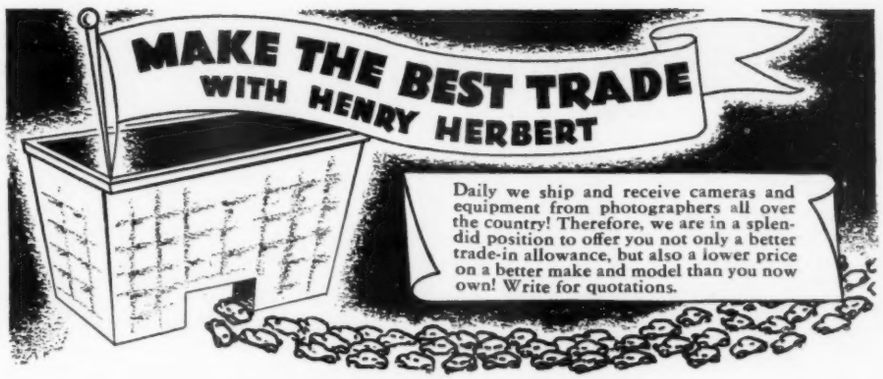
Along with the June issue of "Light Reading," monthly journal of *Toledo* (O.) *C.C.*, members received a questionnaire. This form was provided to give each member an opportunity to express his preferences and dislikes regarding matters of importance to any camera club, such as monthly print contest subjects, loan exhibits, judges, social activities, outings, speakers, etc. Having sat in on more than one oral club discussion of some of the subjects listed, it's our opinion that this is a fine method of obtaining a consensus without wasting time.

Shortly after holding its third annual club banquet, *Rockefeller Center C.C.* (New York city) hung a 216-print show on the mezzanine floor of the RCA Building, Rockefeller Center, New York City. Here's another comparatively young outfit which has made real progress since its organization. . . . Guess that's about all until next month, by which time a lot of you will be on your vacations. In that regard, make a note of any hospitality or other courtesies shown you by other clubs during your travels, will you? And have a good trip!

Print Show Scheduled for British Relief

UNDER the auspices of the Manhattan Camera Club, a photographic exhibition will be shown from Sept. 2 to Sept. 23, at the rooms of the British War Relief Society, 6 E. 57th St., New York City. An admission charge of 25 cents per person will be collected from those who visit the show, the proceeds being turned over to British War Relief.

Upon completing its New York booking, the exhibit will go on display at galleries in Boston, Philadelphia, Chicago, Detroit, St. Louis, and Los Angeles. A group of well-known photographers in practically all fields of the profession is being invited to contribute one print each to the display. The photographs themselves will be offered for sale at the termination of the scheduled tour, thus swelling the proceeds further.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3¼x4¼ Auto Graflex RB F 4.5 K.A.....$95.00
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Argus C3 case.....$22.50
Ikonta A (1⅝x2¼) F 4.5 Novar.....$15.00
½ V.P. Balda F 2.9 Trioplan Compur.....$20.00
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½ V.P. Super Foth Derby F 3.5.....$17.50
35 mm (double frame) Memo F 4.5.....$15.00
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½ V.P. Parvola F 3.5 Tessar.....$30.00
V.P. Dekrullo F 4.5 Tessar F.P.A.....$25.00
½ 120 Duo Six-20 F 3.5.....$32.50
½ V.P. Vollenda F 3.5 R. Compur.....$20.00
9x12 Pack Camera F 4.5 Unofocal.....$27.50
9x12 Voigt. Avus F. 4.5 Skopar.....$30.00
9x12 Voigt. Bergheil F 4.5 Heliar case.....$42.50
V.P. Exakta C F 2.8 Tessar.....$75.00
6x9 Dekrullo F 3.5 Tessar, Meyer R.F., F.P.A.....$60.00
Welta (1⅝x2¼) F 2.9, Compur.....$32.50
9x12 Dekrullo F 2.7 Tessar, Case, F.P.A.....$80.00
Contax III F 2 Sonnar, Case.....$175.00
6x13 Polyscope F 4.5 Tessar, Case, Mag. F.P.A., G.G.....$85.00
Robot II F 2 Sonnar, Case.....$130.00
Auto Rolleiflex (6x6cm) F 3.5 Tessar, Ever. Case.....$140.00
4x5 Speed Graphic 6" Heliar Compur, Kal. R.F.....$95.00

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40 mm Biotar for Contax.....$37.50
75 mm F 2.9 Pentac for Kine Exakta.....$45.00
18 cm. F 4.5 Steinheil Unofokol Compur...$30.00
9½" F 4.5 Goerz Dogmar Compound.....$90.00
6½" F 4.5 C.Z. Tessar Focusing Mount....$25.00
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18 cm F 3.5 Xenar barrel.....$45.00

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Weston Prof. Model.....$20.00
Photrix Prof. Model.....$20.00
Grant 35 mm Enl. F 3.5 lens.....$17.50
Federal 230 (2¼x3¼) F 6.3 lens.....$15.00
2¼x2¼ Praxidos F 4.5.....$15.00
2¼x3¼ Eclipse F 4.5—like new.....$30.00
2¼x2¼ Dearorff F 4.5 Componar.....$22.50
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Robot I, F 3.5, C.Z. Tessar. Reg. $115	49.50
Leica A, F 3.5 Elmar Perfect	27.50
Leica D, F 3.5 Elmar, Rg. Finder	69.50
Contax I, F 2.8 C.Z.T. Rg. Finder	79.50
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Notes on the Salon Section

PAGE 19—PICTURE OF THE MONTH

This fine picture by Elise Voysey, Bayville, N. Y., was a prize-winner in the 1940 POPULAR PHOTOGRAPHY Picture Contest. It was taken with a 2¼ x 2¼ Super Ikonta B and *f* 2.8 Zeiss Tessar lens. The exposure was 1/100 second at *f* 8 with a medium yellow filter, on Agfa Superpan film.

PAGE 39—SWING HIGH

Thomas E. Benner, Urbana, Ill., took this picture with a Watson View camera and the 13¾" element of a Bausch & Lomb Protar. Exposure was 1/25 second at *f* 16 on Eastman Super Ortho Press film. The picture was taken with the swing hanging at rest, and the camera was tilted sideways at an angle of about 45 degrees. The girl "pushing" the swing was supported by props which enabled her to lean back far enough to give the desired effect. This photograph was a prize-winner in the 1940 POPULAR PHOTOGRAPHY Picture Contest. Clouds from another negative were added when the enlargement was made.

PAGE 40—SURREALISM

The photograph by Watson Lewis was taken with a 9 x 12 cm. Certo Sport and 5" Zeiss Tessar *f* 4.5 lens. One 450-watt spotlight and a small Photoflood were used to illuminate the setup. Exposure on supersensitive panchromatic film was 2 seconds at *f* 22.

William Langdon took this picture with a 4 x 5 Korona view camera and 6" Zeiss Tessar *f* 4.5 lens. The setup was arranged in his studio, and lighted with one spotlight and a fill-in floodlight. The exposure was 1 second at *f* 32 on Agfa Isopan film.

PAGE 41—COOLING

Arthur J. O. Romero made this picture with a 2¼ x 2¼ Automatic Rolleiflex and 7.5 cm Zeiss Tessar *f* 3.5 lens. Exposure was by synchronized flash on Agfa Superpan Press. An Abbey flashgun and No. 0 Wabash Superflash lamp were used. The picture was a prize-winner in the 1940 POPULAR PHOTOGRAPHY Picture Contest.

The photo by Mrs. Marian Manning, also a 1940 Contest winner, was taken with a 2¼ x 3¼ Plaubel Makina and 4" Plaubel Anticomar *f* 2.9 lens. The exposure was 1/200 second at *f* 9 on Eastman Super-XX film.

PAGES 42-43—TWO FIGURES

These four pictures by B. W. Leroy illustrate the manner in which figures in the foreground enhance the pictorial quality of scenics. The two photographs on page 42 were taken with a 2¼ x 3¼ Super Ikonta C and 4½" Zeiss Tessar *f* 4.5 lens fitted with a medium yellow filter. The exposure in each case was 1/50 second at *f* 11 on Agfa Superpan film. Both of the pictures on page 43 were made with a 3¼ x 4¼ Series D Graflex and 6½" Zeiss Tessar *f* 4.5 lens. Here a deep yellow filter (Wratten G) was used, and the exposures were 1/65 second at *f* 8 on Defender X-F Panchromatic film (top picture), and 1/65 second at *f* 11 on Eastman Super-XX film (bottom picture).

PAGE 44—FLOWERS

The two photographs by LeVerne Osdal were made with a 2¼ x 3¼ Kodak Six-20 and 4" Kodak Anastigmat *f* 6.3 lens. The flowers were photographed through one of the elements of a pair of ordinary sun glasses, which served as a filter. Exposure was 1/50 second at *f* 16 for the hollyhocks; for the tritomas he stopped down to *f* 32 and made a short exposure by bulb. Both pictures were made on Eastman Super Sensitive Panchromatic film.

PAGE 45—SATISFACTION

Torkel Korling, Chicago, Ill., took this fine picture with a 4x5 Series D Graflex and 8¼" Zeiss Tessar *f* 4.5 lens. Exposure was by open flash, using two G.E. No. 10 Photoflash lamps, with the lens stopped down to *f* 22, on Defender X-F Panchromatic film.

PAGES 46-47—ACTION

This selection of striking photographs demonstrates William M. Rittase's ability to take fine action pictures of all kinds.

Into the Stretch was made with a 3¼ x 4¼ reflex camera and 6¼" Zeiss Tessar *f* 2.9 lens. Exposure was 1/500 second at *f* 8 on Agfa Superpan film.

Outboards was taken with the same camera, and the exposure on Agfa Superpan was 1/300 second at *f* 11.

Reach. Here Rittase used a 3¼ x 4¼ Speed Graphic with 6¼" Zeiss Tessar *f* 4.5 lens and a medium yellow filter. The exposure was 1/1000 second at *f* 11 on Agfa Superpan film.

Double Dive was also taken with the Graphic, but without a filter, and the exposure on Agfa Superpan was 1/1000 second at *f* 8.

PAGE 48—TRACES

The photograph by V. F. Melchore was taken with a 2¼ x 2¼ Super Ikonta B and 3⅛" Zeiss Tessar *f* 2.8 lens on Agfa Superpan Press film. The camera was set up on a tripod, the lens stopped down to *f* 16, and an exposure of 10 seconds made. This picture was a prize-winner in the 1940 POPULAR PHOTOGRAPHY Picture Contest.

The picture by F. P. Baldwin, another prize-winner in the 1940 Picture Contest, was taken with a 9 x 12 cm Kodak Recomar 33 and Kodak Anastigmat *f* 4.5 lens. The exposure was 1½ minutes at *f* 11 on Agfa Superpan Portrait film.

PAGE 49—SIDE-SHOW

These splendid carnival pictures by Peter James Samerjan were both taken with a 4 x 5 Series D Graflex and 8¼" Steinheil Cassar *f* 3.5 lens.

Step Right Up! This photograph was taken at the Pomona Fair, Pomona, Calif. Exposure was 1/50 second at *f* 16 on panchromatic film. Samerjan waited from 8 in the morning until 3 in the afternoon to get the picture just as he wanted it.

Mammy! This shot, taken at Cole Bros. circus, was made from a vacant ticket seller's stand which provided a fine spot from which to shoot a closeup. The exposure on panchromatic film was 1/200 second at about *f* 8.

PAGE 50—NEGATIVE

Ira Arnot made this negative by direct exposure in the camera on a piece of bromide enlarging paper. While this stunt is not new, it is seldom that such excellent results are obtained. Arnot took the picture with a 5 x 7 studio camera and Cooke lens. A filmholder was loaded with a 5 x 7 sheet of singleweight Agfa Brovira glossy paper, No. 2 contrast.

The model was posed, and lighted by means of a Cooper-Hewitt M tube and one No. 2 Photoflood lamp. The negative was then made in the ordinary manner except that, since the paper is slower than film, an exposure of ½ second at *f* 4.5 was required. The negative as shown here is a portion of the original 5 x 7, which has been enlarged to page size. Arnot made positive prints by placing the paper negative in his enlarger and projecting to the desired size.

THE AUGUST COVER

This month's cover illustration was reproduced from a Kodachrome transparency made by André de Dienes, professional photographer, New York City.

He took the picture with a 3¼x4¼ Graflex camera and 8" Zeiss Tessar *f* 4.5 lens, and the exposure was 1/25 second at *f* 16 on Daylight Type Kodachrome cut film.

After obtaining a bouquet of flowers, de Dienes arranged the attractive setup with the aid of two professional models. In addition to placing his subjects so as to obtain a pleasing composition, he used a high camera angle in order to take full advantage of the flowers as a colorful background pattern, and to eliminate sky and horizon.

London Salon Invites Americans to Enter

ALONG with a cordial invitation to American photographers to submit prints to the London Salon of Photography this year, word is received from England that conditions of entry have been facilitated greatly. Where packages of pictures are clearly marked *"Photographs Only for Exhibition—No Commercial Value—to be Returned to Sender,"* there will be no difficulty about their reception and delivery in London.

Entry blanks will not be required by American entrants who fulfill the following major requirements:

Pictures must be sent unmounted, by printed matter post, letter post, or parcel post only.

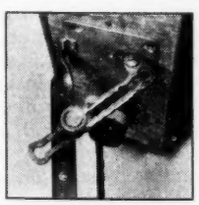
Each print must bear on the back, clearly written, the number and title of picture (to correspond with entry form or other list of prints sent), and the name and address of the entrant. Maximum acceptable print size is 25 x 20".

Entry forms (or a clearly-typed or written list of prints submitted) must be sent *separately* by post, together with an entry fee of 5 shillings or equivalent. Do not enclose entry blanks, list of prints, or entry fees with the prints.

Exhibitors should signify whether or not they agree to having their pictures reproduced. Copyrights remain the property of the makers of the prints. Final date of entry is September 3, 1941. For information regarding how to address your entries, consult the Salon Calendar which appears on page 66 of this issue of POPULAR PHOTOGRAPHY.—►

Tilting Head for Lamp

AN exceptionally serviceable tilting head for heavy lighting units can be found in auto junk yards. After building a heavy unit to provide sufficient light for taking indoor color movies, we found that it was too heavy for an ordinary swivel head. After scouting around, the problem was solved by using the windshield levers which were employed on old cars.



Head on stand.

One of these levers was taken from a junked car, at a cost of fifteen cents, and pressed into use. The stand which we used had a ⅜" rod for the top extension. An 8" piece was cut off the rod, and tapped to take screws to hold the brace in place. The pans were drilled for bolts and nuts, the other end of the bracket fastened to the pan, and the movable joint was screwed to a butt-hinge, which in turn was fastened to the lighting unit as shown in the illustration.

The short piece of rod was used because the unit had to stay on the pans at all times, and the shorter rod made the unit more portable.

The result is a heavy duty tilt top, which has a convenient knurled knob for easy adjustment, and which holds the lamps rigidly in any position.—*Maurice Frink, Jr., Greencastle, Ind.*

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Latitude in Color Exposure

(Continued from page 38)

the exposure from that meter reading.

Again if the brightest object in the picture measured 500 I would know that I could not satisfactorily record an object that measured only 25. The darkest object should be not lower than 1/10 of 500, or 50. To determine the correct exposure, again set the arrow on the light meter at a point halfway between 50 and 500, which would be at 160, and take the picture at the exposure there indicated.

The accompanying illustration shows a black-and-white print made from a Kodachrome transparency. Lettered on the picture are the meter readings for various portions of the scene. The brick wall in shadow gave a reading of 20, in sunlight, 250; green tree in sunlight, 160; green grass and brick pavement in sunlight, 250. No reading was made for the dark foliage which frames the picture, as underexposure was desired. Nor was it possible to get a reading for the stucco wall in sunlight (second floor) or the slate roof, but both would probably read 400, the same as the concrete pavement in sunlight.

In determining exposure, color in the dark green foliage at left was not considered, as it was to serve as a dark frame. Considering the brick wall in shadow, it was desirable to have some color appear, though not necessary that the grain of the bricks be brought out in full. Therefore, instead of giving this wall an underexposure of five Weston dial readings (which would bring out the full grain of the bricks but would overexpose other parts of the picture) this area of the picture was given an underexposure of *eight* readings. That is, the arrow on the meter dial was set eight steps above 20, which is 130. Computing the exposure at this reading, the areas reading 250 were well within the latitude of Kodachrome set forth above, and the stucco wall and slate roof (probably reading 400) came *exactly* at the upper limit—five steps above the reading of 130.

Of course there are commonsense limitations to this usage, similar to what would be found in black-and-white photography. If 90% of the scene to be exposed gives a meter reading of 320 and a mere 10% give a reading of 32, I would not overexpose the 90% in order to bring out the 10%. Rather, I would rearrange the picture. I am referring here to scenes where the brightest and darkest objects are more nearly equal, and where much of the scene gives a light reading that is more or less half way between the two extremes.

Suppose you have scenes of extreme brightness range. Can they be photographed? Yes, and rather well too. This is done by playing a trick on the eye. After all, playing tricks on the eye in photography is old. It is the foundation of all moving pictures. Everybody knows that the objects on the screen do not really move, but are merely still shots thrown on the screen so rapidly that they seem to be moving.

In the same way, but by using a different principle, we can trick the eye in color photography. Suppose most of our scene to be photographed is rather dark—giving, say, a Weston reading of 13 to 25—but that *part* of the scene gives a brilliant reading, say 320 or more. This is obviously too great a brightness range to record by orthodox methods. So we resort to eye trickery.

To see how it is done, look at the scene you are going to photograph. If you gaze at the brilliant sections of it, then suddenly shift your gaze down to the darker portions of it, for a few seconds *you cannot see these dark portions distinctly.* Why? The iris of the eye has contracted to receive the bright areas, and now when it is shifted suddenly to a dark area it seems almost black, until the eye has time to readjust itself.

Next, reverse the process. Remember that most of your scene is dark, reading from 13 to 25, but that part of it is brilliant, reading 320 or over. So shield your eyes from the brilliant area and look only at the dark area until the eye is accustomed to the dim light. Now look up suddenly at the brilliant portion of the scene. The brilliant light will register on the eye like overexposed objects on the film. But we are so accustomed to scenes like this, that this sort of overexposure seems to the eye perfectly natural and proper. On this principle we photograph our scene, making a compromise exposure. This will give some detail in the shadows, and will overexpose the highlights only about as much as the normal eye will accept as a reasonably accurate reproduction of the scene.

We agreed that Kodachrome has a *normal* latitude of 10 (as stated in the first part of this article). This means that if the darkest part of the scene reads 16 we set the arrow 5 steps above 15, which would be 50. In other words, any area in a picture will still come in on the transparency with reasonably good color richness even if it is given a 5-step underexposure on the Weston scale.

Very well, then, if our darkest scene reads Weston 16, we simply count 5 steps up on the Weston scale of light values. That gives us 50. So we set the arrow at 50, see what the reading calls for, and take the picture at that exposure.

What happens on the transparency? The darkest part of the scene, with the reading of 16, will be dark, but nevertheless distinct. The lightest part of the scene—with the reading of 320 or more—will look overexposed in the same way that it looked overexposed to the eye when you stood at the original scene and looked up suddenly from the dark part of the scene to the bright. But the eye is so accustomed to this sort of overexposure that it seems as though you have just looked up from the dark part of the scene to the bright. The scene does not appear to be overexposed at all. It only seems natural.

You don't believe it? Try it.—▶

Many Titles Suggested for Flash Prize Winner

AFTER awarding a first prize in the First National Flash Photography Contest to George Keneson's amusing shot, "Buck Fever," POPULAR PHOTOGRAPHY invited readers to suggest titles which they felt might be suitable for the same picture. The vast number of people who came up with "Bare Facts," "Bare Meets Bear," "Bare Hunting," and "The Bare Hunter," have made it virtually impossible to list them all without considerable duplication.

Among the many other suggestions, the following were especially interesting:

"Trouble Bruin," Gordon M. Berns, Rochester, N. Y.

"Oh, oh!," A. N. Thorndike, Chicago, Ill.

"Bug-Eyed," Mrs. Arno W. Sommer, Elmore, Minn.

"Plumb Scairt," C. S. Barnhill, Jacksonville, Fla.

"It's a Bearfaced Lie," Buford Isham, Grass Valley, Calif.

"Pop-Eyed," Hyatt Smith, Buffalo, N. Y.

"So You're the One," Freeman P. Taylor, Saint Petersburg, Fla.

"Cripes!," Alford Van Ronkel, Chicago, Ill.

"On the Spot," Frederick J. Kraus, East Orange, N. J.

"What Do I Do Now?," George R. Stewart, Los Angeles, Calif.

"Wow!," John Scherlacher, Pittsburgh, Pa.

Hotel Installs Darkrooms for Use of Guests

THE needs of the traveling amateur photographer have been attracting more and more interest on the part of the hotel industry. Recognizing the desirability of providing proper facilities for its camera-minded guests, the Hotel Stevens of Chicago, Ill., is installing darkrooms, and club facilities.

Two developing rooms and two printing rooms, completely equipped, will be available to guests when the camera club is completed. There also will be a meeting room, with screens for motion and still projection, seating 50 persons. This room will be available without charge to various smaller clubs of the Chicago area. For the casual visitor, there will be a comfortably-furnished lounge where amateurs can meet and talk photography. Attendants will be on duty in the darkrooms at all times.—

New Light Polarizer

A NEW type of light polarizer which uses individual molecules instead of crystals as "combs" to line up the light vibrations, has been invented by Edwin H. Land, president of Polaroid Corp., Boston, Mass. It transmits one-third more light than previous Land polarizers, and polarizes over 99.99 per cent of the light vibrations lying in the middle of the spectrum. It is reported to be so efficient that two sheets of it, with their "optical slots" turned at right angles, cut off the light of any ordinary source like a 100-watt electric light bulb and make it invisible to the eye.—

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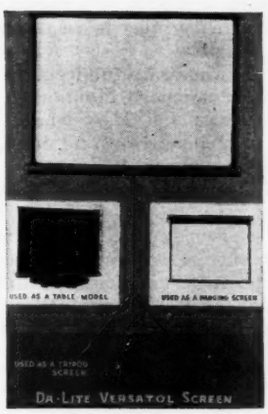

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Filming a Vest-Pocket Travelog

(*Continued from page 33*)

hand slowly turning the pages of a guide book, stopping here and there to show actual scenes at strategic spots. Titles are worded to fit in with the summerland continuity, and these should be informal as well as descriptive.

A short time ago I had an opportunity to shoot a vest-pocket travelog of my own when my pal and I set out on a 7000-mile camping and fishing trip by car into the Pacific Northwest. We had no definite plans. We decided to take things as they'd come, often acting on the spur of the moment. This complicated the filming problem, for it was difficult to tell how much footage to expose at any one spot and how much to save in reserve for possible future scenes. To add to our troubles I decided, as an experiment as well as an economy move, to limit my raw movie footage to exactly 400 feet of Kodachrome. Out of that I would see if I could work up a 400-foot travelog. Professional cinematographers might shoot 100 feet of film to get 5 good feet. Amateurs, less fortunate than their Hollywood brethren, must learn to make every frame count.

Our first stop was beautiful, ice-crusted Glacier Park in northern Montana. This place is a cameraman's Eden, where the tendency is to shoot everything on sight and go out after more. We camped for several days on the shore of Swiftcurrent Lake, hiking over the many foot trails and boulder-strewn passes. The first part of Reel One carried scenes which were recorded in the order taken and identified as long shots (LS), closeups (CU), or medium shots (no key). The list read as follows:

OK mountain framed thru shelter
OK LS another mountain
OK Two-Medicine Lake & mountain
OK LS Trick Falls
OK CU Trick Falls
CUT CU Glacier Park sign pan left
OK 2nd half showing car entering
OK Ranger walks out of checking station
OK CU Ranger
OK CU Glacier Park Sign
CUT sign: Rising Wolf Mountain

Rarely are scenes taken in the exact order in which they are finally used, and the above were changed about to show a closeup of Glacier Park sign, a long shot of the checking station as a ranger walks out to meet an approaching car, a closeup of the ranger, and a framed shot through the shelter showing a mountain in the background and a car fading away. Trick Falls and Two-Medicine Lake were cut in a bit later. To give the feeling of movement, two or three shots were obtained showing the car swinging around a curve, with a snow-plastered mountain background. When a particularly picturesque view would appear, I would get out of the car, crawl up a bank, and, on the proper signal, start filming the road and mountain drop as the car passed through the scene.

To reduce weight and bulk, I broke all photographic rules by traveling without benefit of tripod. However, I did no shooting with the hand-held camera. I found natural "tripods" everywhere—stumps, signposts, tops of boulders and sides of trees—and always employed one of these supports before pressing the trigger. Sometimes I obtained a worm's eye view by resting the rear of the camera on the ground and the front on my boot to shoot upward at a steep angle.

During our hikes over glaciers and up to Iceberg Lake, I had ample opportunity to pick the best shots. On Ptarmigan Wall, I framed an interesting silhouette scenic through a tunnel of rock. Along the trail were bright-eyed flowers popping up through the retreating snow. To give mountain breeze action to one flower cluster, I had my partner, just out of camera range, blow until he was red in the face. The artificial movement gave just the right effect.

Shooting tell-tale signposts alone was not enough. To work in the human angle on our hikes, I would fade in on a white-enameled sign, and into the scene would walk my partner to rest while he looked upward at the mountain described. Then would follow a long shot of the peak. Pan-ups were made from closeups of feet stumbling along the trail to long shots of glacial scenery with the hiker fading away in the distance. Glimpses of striking peaks were filmed while coming down off Logan Pass, and here we encountered a cinnamon bear cub near the highway. By driving along very slowly in low gear, the bear managed to keep walking a short distance behind the car to provide a fine moving camera shot.

While tramping along the shore of McDonald Lake in Glacier one night, we decided that we would break camp on the following morning and go on to Mount Rainier in Washington. Rainier was a marvelous sight. Too many tourists find it completely cloaked in fog, but we experienced only the finest weather for filming. One day a thin halo of clouds formed about the frosty peak, and I took this much-prized shot by including a dark corner of our cabin in the foreground for depth. Other scenes were taken in Rainier, all of which were preceded by a medium shot of the rustic archway sign at the park entrance.

Oregon's Crater Lake, formed deep in the belly of an old volcano, furnished our next movie subject. A closeup of the Crater Lake plaque in the observatory offered a quick glance at the topography of the entire area. This was followed by my companion in silhouette looking through binoculars at well-framed views of Crater Lake. A chance closeup of a kingbird in a nearby tree provided a convenient break in the long line of scenics. Back in western Montana a pack trip into beautiful Hellroarin' country was awaiting us—a trip which in itself would have made an interesting feature film.

On a previous trip I had made a black-and-white study of Yellowstone, so we evaded geyserland completely while en-route south to the Tetons. These peaks are so rugged that even snow cannot stick to them, and because of their position in relation to lighting, they are even more difficult to film. Here I saw an artist painting a bit of mountain on her canvas. I faded in on a closeup of the scene being painted, then panoramed up very slowly to reveal the distant range. This meant a sudden spin of the lens barrel to change focus during the pan. Overshadowed by the mighty Tetons is a rustic little church with its famous "living window"—a large, glass-covered opening behind the altar cross through which worshippers can see the far-off ranges beautifully framed. I took a long shot of the mountains with the church in the nearby foreground, and then went inside for a follow-up on a framed shot through the window.

While crossing Wyoming's badlands into the Big Horn country, I realized that we had practically no wildlife stuff. We had seen a few mountain sheep in Glacier's upper stretches, but they were so far off that even a 3-inch telephoto couldn't bring them in. Camping beside Crazy Woman Creek one night, we noticed that a fellow camper had a live domestic goat with him, which looked a bit like a wild mountain goat. I took several views of the animal as it browsed through the grass banking the stream, then made a closeup of the camper actually milking the goat.

To make the sequence complete, we needed shots of both my partner and I looking through binoculars at this apparently ferocious critter. This was solved by my shooting up from a low angle as my partner adjusted the binoculars, lowered them from his eyes and passed them with his left hand out of the picture. Then the camera was stopped as we quickly exchanged places. With my right hand holding the glasses out of camera range, I drew them in as he started shooting, and the effect is the same as though, standing side by side, we had passed the binoculars from one to the other. These scenes were interspersed with the goat shots, and all except seasoned hunters detect the difference at first between the domestic and the wild variety. In fact, some audiences lean over backwards to compliment you on your filming ability, until the sequence ends with the camper milking the animal. This is always good for a chuckle.

Approximately 10 feet of film remained unshot after our return home, and this was used for a special introductory sequence which was filmed in our back yard. The camera was set on its tripod pointing down at a grassy patch strewn with colorful flowers. In the center of the scene lay several National Park booklets. One by one each is removed, revealing the Tetons, Crater Lake, and Rainier, until only the Glacier Park booklet remains. From this scene, a quick jump is made to a closeup of the Glacier Park sign on location, and the film gets under way.

Working up continuity seemed to pre-

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sent quite a problem until it was discovered that all scenes had something in common. Mountains! They weren't easy mountains to reach. You had to go to them. They wouldn't come to you. That gave me an idea. Somewhere I had read about some old prophet who had said that if the hills would not come to Mahomet, Mahomet would go to the hills. So I main-titled my feature, *Mahomet's Mountains*, worked in the quote at the beginning, and followed with:

> What a pity this wise old prophet never saw America's frosty foothills! What praises to Allah he would have sung!

The Mahomet angle is again brought into the hiking scenes in a title reading:

> For men like Mahomet who like to hike, there is hiking.

And for the closing sunset:

> Even Mahomet could not have wished for a prettier sight.

No doubt more footage would have made an even more interesting movie story, but the limitations probably made for much more careful shooting. Hardly 50 feet of film was cut out of the finished 400-foot reel—just enough to replace with title wording.

As a new experience in amateur movie making, however, vest-pocket travelog filming does have its advantages. Next time you go jaunting, try your hand at more conservative filming, and find out for yourself.—

Beach Pictures

(*Continued from page 29*)

certain desired results in working with the many different types of subjects possible. A yellow filter will enhance the texture of the sea and give good contrast between sky and horizon, but with portraits or closeups of people in the immediate foreground, an excessive contrast is likely to result with consequent "chalkiness" in skin texture and loss of that "beautiful tan" of which the subject is proud. A light green filter is preferable to yellow in portraits or closeups. It will darken the usually bald sky, yet it will not lighten the skin tone to a marked degree. Where palm fronds and foliage are included in the picture, on the tropical beach of Santa Catalina, the green filter will bring out the texture of the leaves and will preserve their cool realism without producing a "blackout." A red filter is not a necessary part of the regular equipment. It should not be used when people are of any importance in the picture, except for special contrast effects as with sailboats on a dark sea or billowing clouds on the horizon. While pictures can be made without filters, the intensive light found at the beach due to reflection from the sand and sea calls for one, and the usually bald sky needs correction and increased contrast.

As to film, it is recommended that a medium-fast panchromatic emulsion be used. Too slow a film will not permit an exposure fast enough to stop the action usually found in beach activities. By all means, take plenty of film. You'll be surprised how many things you can find to shoot once you start looking for pictures.

Now as to what to shoot. Needless to say, your photographs should have *general* interest rather than a personal interest if they are for others to admire. If you make a picture of the girl-friend, make it interesting to the casual observer as well as to yourself. Find a good setting where the background will not contain crowds of people or a lot of miscellaneous objects. If a person is to be the center of interest in the picture, put him right up in the foreground of the scene. Naturalness in posing always makes the better picture, with the subject apparently not conscious of the camera. On a wide expanse of beach with no props or trees, it is difficult to make an attractive photo of a person standing and doing nothing. Better have the subject lie down on the sand. "What shall I do with my hands?" is the most frequent query of the inexperienced model. Pose her against a rail, a sea wall, a palm tree, or holding some object such as a beach ball, sunglasses, towel, or other article.

Lighting on the beach is particularly difficult because of the overhead position of the sun in summer when vacations usually are taken. For this reason it is best to do most of your shooting before 11 o'clock in the morning or after 2 o'clock in the afternoon when the sun gives a fuller side light. When shooting under the harsh light of an overhead sun, a reflector is practically a necessity to fill in the deep shadows and especially to cut through the black circles under the eyes caused by overshadowing eyebrows. If you don't have a reflector, a white towel, white paper, or similar object will serve. Synchroflash, of course, will do the trick. If you have nothing of this sort, pose your subject close to the reflecting sand, sea, or a bright wall. This procedure is also recommended for backlighted shots to give the desired effect.

Be sure to watch the background in your closeups. On the beach the principal risk in this respect is an inelegant posture on the part of someone else in the distance. It might be necessary to use a faster exposure and wider lens aperture in order to throw the unwanted background out of focus. It is usually best to shoot toward the sea rather than toward buildings or cliffs behind the beach in order to get proper separation of your subject. In such instances a low camera angle is desirable.

There are countless subjects for your lens at the beach. Children at play building sand castles or at the water's edge make interesting human-appeal pictures. With children, it is recommended to shoot them as they play, with no attempt to pose them. They are much more appealing that way, and they are usually too difficult to pose—apt to go temperamental on you. You'll have to expect sudden motion, of course, so use a fast shutter speed; 1/200 second will generally stop action. Because children are usually close to the sand or the water's edge, the reflection of light will obviate the necessity of a reflector.

Beach sports provide appealing subject

material. Surf-riding, paddleboarding, volley-ball, tumbling, and diving call for even faster exposures. A person jumping after a ball or diving into the water usually cannot be stopped on the negative with a shutter speed slower than 1/350 second. However, if your shutter is not that fast, look for a peak of motion, or the point when action is momentarily suspended, then click the shutter.

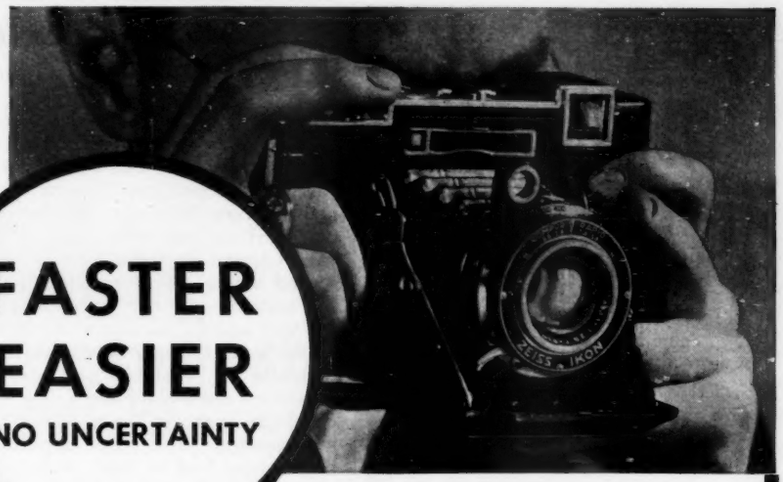
So-called "candid" shots on the beach are often interesting. But beware of photographing persons, either your friends or strangers, in inelegant or unflattering poses. It is true that pictures in this latter category might catch the interest of some people, but they are unworthy of the field of amateur photography.

General views of the beach, or "scenics," should include some identifying landmark if it is to serve as a reminder of your vacationland. A well-known pier, building, or promontory of land—the boardwalk of Atlantic City, the palms of Miami, the cliffs of Laguna, or the Casino of Santa Catalina—will remind you of the place in the years to come. In scenics, it is always well to frame your pictures with a palm tree, a lifeguard station, or other object for better composition.

Exposures at the beach vary, depending on the lighting and the film used. Therefore it is impossible to give specific data on actual lens apertures and shutter speeds that would be accurate enough for each photographer. Light conditions vary according to the time of the day, condition of the weather, and other factors. If you have an exposure meter, consult it for every picture you make. You'll find that what you *think* would be the proper exposure probably *isn't*. The intense light found at the seashore is apt to fool even the best of photographers unaccustomed to working under these conditions. If you do not have an exposure meter, there is one general rule to follow—stop your lens down at least one full stop more than you would if making the same picture on a bright day in the city or in the mountains. In other words, give the negative one-half the exposure that you would ordinarily make.

The last rule for beach photography—and probably the most important if you value your equipment—is to take special care of your camera. The salt spray in the air plays havoc with shutters and moving parts, and is also apt to coat the lens with a fine crust. It is good practice to carry lens tissue or very soft cloth and wipe the lens frequently. Never set your camera down on the sand. Fine particles are apt to get into the moving parts, are extremely difficult to remove, and often are the source of those mysterious scratches on your film. Whenever you set your camera down, be sure to cover it up so a running passerby will not kick sand over it.

Take your camera, lots of film, your lens shade, and a yellow and green filter to the beach, and follow these simple rules of procedure. You'll get lots of interesting pictures, and some of them may be worth hanging in a salon. At least they'll be a source of personal satisfaction, and a fine addition to your photographic album.—



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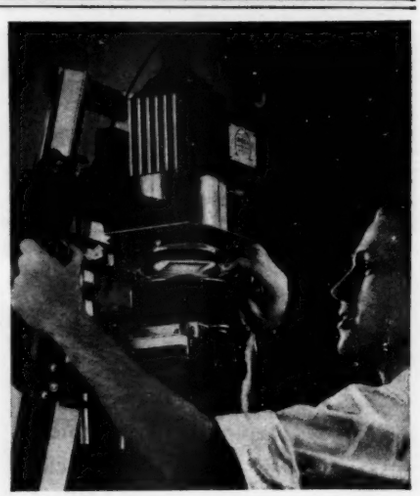

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Giant Camera Speeds Defense

(*Continued from page 21*)

Four years ago the ordinary template-making procedure was lengthy and laborious. The draftsman's work was blueprinted, then sent on to the template department. There the original drawing was redrawn on metal terne-plate (lead-coated steel). The drawing instrument was a scribe—a sharp-pointed stylus. The job was one for an engraver, and it took as many as 400 man-hours to inscribe a template for a single part. A mistake meant a wasted plate and a new start, because no erasures were possible on the lead coating. The other departments in the factory had to wait while the template was being completed.

That was a tough bottleneck to crack.

Washburn, familiar with plane factory procedure and photography, began to investigate the possibilities of answering the idly-posed question of a few years ago. There was no answer available anywhere, even if the aviation industry had been ready to make the necessary investment in money and space. None of the commercial photographic manufacturers made anything that indicated the practicability of photographic templates.

An emulsion-coated metal plate suggested itself. But it isn't easy to coat metals with photographic emulsions. The problem of finding a method of sensitizing metal with a bromide emulsion was solved eventually in the Eastman and Hammer laboratories. That was one blow at the bottleneck. After that, various "bugs" had to be ironed out. One of them pertained to the color of the metal sheet. White, or light color, was desirable for those partial drawings which would go back for additional work after being photographed. Then efficient methods of handling the metal plates through the various stages of exposure, development, and fixing had to be found.

The Lockheed department went to work on its problems in sequence. A "lofting" camera was designed by Robert Moore, Lockheed engineer, in collaboration with Washburn. This giant camera, which uses a Cooke *f* 12.5 process lens of 19″ focal length, is called the "Wigwam" by the staff and does, in fact, resemble a square tepee. It is five and one-half feet square at the base, tapers up to the lens board, then flares out to accommodate the 14 x 17 plateholder which is standard in the department for lofting work and the later stages of the process. The camera, which can be rolled around the drawing lofts, was built in the Lockheed experimental shop, carries eight 48-inch fluorescent daylight tubes, two on each side at the base, to illuminate the drawing on the gigantic drafting board. It has fixed focus and fixed illumination, and can be used by anyone who can be taught to pull a slide from a holder and turn on a light switch. Exposure is standard.

After the loft picture is made, the photo department develops the plates and puts them into a special combination projector and camera built by the Rutherford Machine Company. The device is an adaptation from the photoengraving industry and is Gargantuan in size. This camera is 34 feet long. It has no bellows. Instead it is actually a dark room 16′ x 25′, one wall of which contains the lensboard. The 18-pound lens in the wall is a 70″ Goerz Artar *f* 16. The sensitized metal plate is suspended in the room and the glass negative is set up in another 16′ x 25′ room beyond the wall which holds the lens. The distance between the metal plate and the negative is determined by the size of the projection desired. The lens is always stationary.

The huge camera-enlarger handles sensitized metal plates up to 4′ x 12′. There is no hand manipulation involved. An overhead electric crane carries them on a monorail through the various steps of exposure and development. The "Photo & Pacific" railway, as the monorail system is known in the department, takes the giant plate from the camera to the laboratory and dips it into the various tanks. The developing tank is 12½′ x 5′ x 3″ and holds a mere 115 gallons of solution. The hypo tank is 12½′ x 5′ x 24″ and holds 900 gallons. A single load requires 1800 pounds of hypo. Constant temperature is maintained in the tanks by refrigeration. Washing is done under spray pipes.

Immediately after making the projection print on metal, another one is made on sensitized tracing cloth. The blueprints needed in the various departments of the plant are made from that tracing. The metal plates go to the shop for use as templates, bringing the finished plane to the runways two to four months ahead of the old schedule.

The camera system of bottleneck-breaking diverts approximately two-thirds of the template men to other uses, according to Lockheed's loft engineers. Template development work itself is not eliminated, but the duplication of effort which wastes time and money is. Complicated or simple, templates are all the same to the Lockheed cameras. The time taken to process them photographically is the same. Delivery can be made in 24 hours and will be when the three-shifts-per-day regimen now in sight is established. Negatives will be made on one shift, templates on the next, and delivery the next morning. The process could be hastened, but force-drying is neither desirable nor necessary.

The largest single projection possible with the Lockheed camera is 50″ x 90″. The Hammer Dry Plate Company is making metal plates 4′ x 12′ and Eastman is making 30″ widths for Washburn's department. The latest improvement in the process brings metal plates and emulsions to the photographic laboratory as individual items. The plates are then coated as they are needed. The new development was found advisable when shipment of large coated plates brought its own problems. Abrasion marks appeared in spite of the greatest care in packing and shipping. A special crate for two to twelve coated plates weighed 450 pounds,

increasing both packing and shipping costs considerably. Under the new system, emulsions are shipped from Rochester and plates are cut out of Lockheed's own large stock of metals. It was discovered that the coating problem could be overcome more easily than the difficulties of shipping. The possibility of plastic plates has been investigated, but any now available in the proper price range will not hold the necessary sizing.

In addition to a saving of approximately $20,000 per model, the Lockheed photographic process offers certain advantages which cannot be reduced to cash equivalent. Accuracy, for example, is probably the most important factor in plane building. Successful operation, as well as lives, depends on accuracy in the minutiae of plane construction. Whether working at full scale or fractional reduction, the camera permits precise proportioning. Washburn is proud of the fact that the work of his department is accurate to one-thousandth of an inch.

The present trend toward small flying models is also facilitated by the use of cameras in the plane plants. Parts or templates can be made to reduced scale with the new process. Like dress patterns, the photographic templates can be used to match parts against patterns. They can be used also as assembly guides and in making dies. Errors can be rectified by the simplest retouching of all—masking out and redrawing. The projection equipment, in addition, is extremely flexible. On the larger drawings, since blueprints are used for reference only, it is feasible to make scale photographs which increase efficiency with their ease of use. The draftsmen also benefit from the photographic process. The Moore-Washburn Wigwam can be used to photograph a complete family of curves, as in a bulkhead. Then an individual curve can be masked out and the draftsman can use that single curve as his limit.

Lockheed's first photographic template was made on December 26, 1940, after eight months of concentrated experimentation and several years of general photographic investigation. The success of photography in breaking a defense industry bottleneck in one of the country's largest airplane manufacturing plants has led to a general interest in similar photographic technique in other industries. The photographic processes pioneered in the aviation industry are applicable to any other industry which uses sheet metal.

Eventually, in Washburn's opinion, photographic departments will be established by every company of consequence as a regular and increasingly useful production aid. The Lockheed department is not devoted to making templates alone. Every available modern photographic tool is used regularly to increase the efficiency of the vast plane plant. All types of commercial photography, including aerial photography, general copy work, photomicrography, publicity and advertising stills, photostats, and Recordak procedure, are in the repertory of the staff. The Recordak device, for example, does much of the Lockheed filing; 28,000 time cards which ordinarily would require a box

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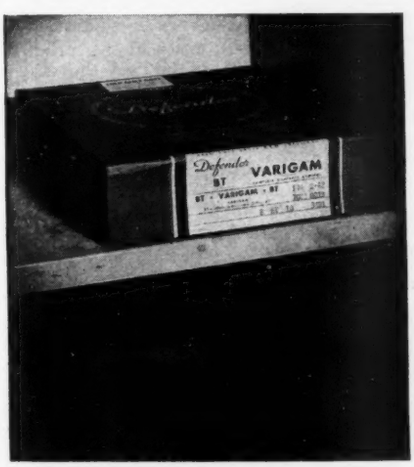

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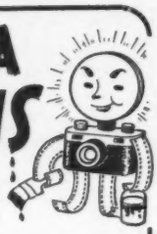

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measuring 3½'x2'x1½' can be recorded on 450 feet of 16 mm film to occupy storage space totaling only 72 cubic inches. A high-speed motion picture camera, with a range of 50 to 2,000 frames per second, is another valuable photographic aid in frequent use at the Lockheed factory. Spinning propellers, machine processes, and other quicker-than-the-eye motions are studied easily with the high-speed camera. Flight recording work today is done with the movie camera, too.

These modern uses of photography open a new field for the future, whether under conditions of war or peace. Lockheed's own department will be operating soon on three shifts, and the present personnel of 46 will be increased to approximately 75. The metal output of the photo-loft-template crew will then be adequate to meet all requirements.

The new industrial developments in photography will bring with them a demand for personnel. Washburn's own basic requirements for members of the Lockheed department are a thorough grounding in photography, plus intelligent curiosity, plus ingenuity in using photography to solve industry problems—plus the cooperative temperament. The present staff is made up of former professionals and amateurs. Two were formerly photoengravers, another was a police department photographer, others had varying photographic experience. Some have technical and engineering knowledge of both photography and aviation. Washburn himself learned his engineering and aviation in the Lockheed plant as he and time went along. In Lockheed's case, photographic department personnel additions will be made from within the plant and from outside. Washburn already has sufficient applications from interested photographers to staff half a dozen such departments as Lockheed is planning.

Industrial photography takes on new aspects and goes in new directions as a result of the work it has been doing in the aviation industry. Instead of merely picturing the men and machines in factories, industrial photography has come to mean the use of photography and its many processes to increase the efficiency of men and machines, and to break bottlenecks in the actual manufacturing of products used for war or peace.—■

Varnish Adds Sparkle

YOU can give your pictures a protective coating that adds sparkle and richness to their appearance by applying picture varnish. A thin coating should be put on with an atomizer, of the type obtainable from art supply stores. This will protect the print from dust and moisture, and make it easy to clean. It will also add a slight sheen to rough-surfaced papers, giving a pictorial effect that is very desirable for many different types of photographs.—*Paul Stiles, New Bedford, Mass.*

Applying varnish.

Make Miniatures

(*Continued from page 63*)

tractive. The same method can be used in making silver or bronze transparencies, which are preferred by some.

The final effect of one of these metallic-backed transparencies of the Doretype variety depends considerably upon the type of gold, silver, or bronze medium used. One of the most satisfactory backings is made as follows:

Obtain some gold, silver, or bronze dusting powder. This is an extremely fine powder used in printer's inks and for fine gilding. It is available at well-stocked paint stores, and only a pinch is required for each transparency. Instead of mixing it with conventional bronzing liquid, use some clear brushing lacquer. Add enough powder to the lacquer to make a fairly thick mixture.

Apply the mixture to the back of the transparency with a soft camel-hair brush of about 1" width. The lacquer bronze will dry in a short time, and if any thin areas appear a second coat can be applied. An atomizer or spray-gun is even better than a brush for applying this or any other kind of paint to the back of the transparency.

Among the other paint-like materials you can use for this purpose are brushing or spraying lacquers in the lighter colors; oil paints of similar hues; and printer's ink, which can be applied with a soft rubber roller.

Glazed colored paper, metal foils, metallic paper, gold leaf, and even polished sheet metal can be used for backing, also. When one of these materials is used, however, care must be taken to see that it is in absolute contact with the transparency over the entire surface of the latter. The pressure exerted in a picture frame may in some cases be sufficient to maintain this close contact. But a sure way of effecting it is to squeegee the transparency against the backing material, using a solution of clear gelatin as an adhesive.

To prepare such an adhesive, soak ordinary unflavored dessert gelatin in cold water for an hour or two, then warm the water until the gelatin goes into solution. Brush this onto either the transparency or the backing, or both, and squeegee them into contact.

You can apply the backing to either surface of the film, but of course you must print the transparency accordingly. That is, if you intend to apply the backing to the glossy side of the transparency, the latter should be printed with the image reversed from left to right. (You can visualize this matter easily by considering an ordinary negative—as you view it with the image in its proper position from left to right, the glossy side of the negative is toward you.)

When the backing is applied to the emulsion side of the film it is closer to the silver image on the film itself, and seems to produce slightly better brilliance. If the image is on a glass plate, the coating generally is applied to the emulsion side. When the backing is placed against the glass (that is, the side

opposite the emulsion), the image stands out a slight distance in front of it, and gives a sort of "double" effect, which you may or may not prefer. The best way of deciding which side of your transparency you want to use for backing is to make some tests.

There is a method of actually depositing a true silver image on one surface of a transparency, but this requires the mixing of certain chemical solutions which are beyond the scope of the average amateur. Furthermore, the excellent results obtained by using one of the methods already described render any complex chemical procedure too troublesome for most purposes.

It is a good idea to lacquer or varnish the front surface of every transparency no matter what type of backing has been used, before framing it. The only possible exception to this rule is a glass plate with the glass side out. Even in this case the image on the emulsion at the back of the frame will be preserved to some extent by a coat of lacquer. Lantern-slide varnish is a good thing to use on film or glass.

Since you're most apt to obtain a frame having a front opening only slightly smaller than the actual size of the film on which you make your transparency, it behooves you to take great care in exposing the transparency in exactly the correct position on the sheet of film. It's too late to do any shifting or cropping after the transparency is made and is all ready for framing, unless you happened to use a comparatively large sheet of film for the small image.

The finished pictures, tastefully framed, make very acceptable gifts, mantel ornaments, etc. By using one of the methods described you can match up old family portraits with pictures of members of succeeding generations, even matching the frames themselves if you're lucky. Or you can make copies of similar venerable portraits and treat these copies in somewhat the same way as the originals as regards framing, gilding, or toning. Nor are the possibilities confined to portraits alone—there are certain kinds of scenic and architectural shots which lend themselves nearly as well to this miniature treatment. The idea has a great many applications, and is well worth the time of any photographer.—

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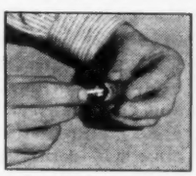
CORKS become dried out and shrunken after a long period of use, and allow air to seep in and shorten the life of developer. While it always is desirable to replace such defective corks with new ones, here is an emergency measure that will provide at least a temporary cure. Simply cut a small hole in the center of the bottom of the cork and insert one or two short, broken match sticks. They will force the cork to spread out, making a tight fit.—*Charles P. FitzPatrick, Philadelphia, Pa.*



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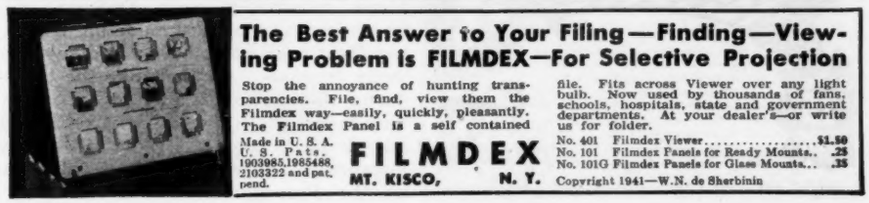
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Fake Pictures in World War II

(*Continued from page 23*)

Herald-Tribune cried "fake" from the top of the front page of its roto section. A search of its files revealed the whole story.

The first time the picture was used, before the start of the war, its censored caption had read, "Sham battle at the army engineers school, Rosslau, Germany, with a flame-thrower going into action against the concrete fortifications."

The second time it was released, at the Berlin premiere, its caption was—"Storming of the Maginot Line, with members of the 'Pionieren' (engineer corps) assaulting a blockhouse weakened by artillery fire."

Slightly different propaganda tactics were observed in another recent case. On release by the Nazi propaganda bureau, the *Associated Press* serviced a picture of a small boat, flying the Nazi flag, with the rock of Gibraltar in the background. The censor-approved caption stated that the picture showed "German tourists seeing Gibraltar." The *AP* noted that reports from Switzerland recently had said that a five-car caravan of German army, official, photo and press experts had been installed at La Linea, a little Spanish town next to Gibraltar. The inference, of course, was that this picture showed a part of that group boating near the Rock.

As a remarkable display of Nazi courage and daring, the picture was little short of astounding. The boat's swastika flag must have been plainly visible from the British stronghold. And undoubtedly the deception would have passed successfully if Lawrence Stuckey, proprietor of a pharmacy in Turn of River, Connecticut, had not spotted the photograph.

"Good grief," he cried. "I'm being used for propaganda purposes!"

Without the slightest hesitation, he pointed out himself and a group of friends. There was nothing faked about the picture. It was real, not a double print job. The swastika flag actually was flying when it was taken. But the print dated back to the summer of 1935, when Mr. Stuckey was publicity man on a Mediterranean cruise of the Hamburg-American Liner *S. S. Resolute*. He remembered the picture quite well. It was snapped on the return from a shore journey, during a regular cruise stop at Gibraltar.

Credit for discovering the largest number of fake pictures, and also the oldest set, must be tendered to Bill White of the New York *Daily News*. In the last eight months, he has spotted three fake news photo releases sent out by the German censors. One showing a bombing plane, reportedly over England, was recognized as a picture made on a training flight over Strausberg, Germany, two years previous. Another, like the transported Nazi howitzers, pictured a railroad gun in action in two widely separated, but strangely identical, spots. The third instance concerned two pictures sent out by the Propaganda Ministry, allegedly showing the sinking of a British ship by a German raider.

When White saw these pictures he almost fell over at the audacity of Nazi publicity men. With the exception of a slight bit of retouching, the pictures were identical with two photographs used to illustrate Lowell Thomas' book on Count Von Luckner, the daring raider of World War I fame.

Early this spring the New York papers carried a picture of a bread line in Brussels, Belgium. Identified by a caption pointing up the food shortage in Belgium caused by the British blockade around German occupied countries, the picture was said to show "a queue of housewives and men before a butcher shop which doles out the meager supply of meat alloted to each person." Originating in Belgium, the picture obviously had to pass the German censors before its release. As a potent argument in the discussion of whether this country should send food to the occupied countries, the photograph undoubtedly had a certain effect on public opinion. However, a sharp-eyed reader noted the deception in it.

Although presumably it had been taken a few weeks before date of release, in other words in the heart of the European winter, it showed the people in the bread line lightly clad. One man was wearing a straw hat. A little girl wore only a thin cotton dress—no coat. Finally, the reader pointed out that the store awnings were still up. If the picture had been taken during the winter the awnings would not have been visible. Belgian shop keepers, he explained, always take down their store awnings when winter comes.

The Nazi Propaganda Ministry is not the only agency turning out fake pictures. Editors recently noted a striking similarity between a pair of photographs from the British. The one that appeared first was a shot of a gun tractor bouncing across a testing field in Canada, undergoing tests after manufacture in a leading Canadian automobile factory. The second was captioned as a picture of a gun tractor working out in maneuvers in North Africa.

Of course, propaganda agencies cannot be accused of deliberately planning the release of every picture that appears with a misleading caption. There are chances for error on the part of their staffs, which handle a large volume of pictures, and the picture services in this country are not immune to mistakes.

So goes the battle of the editors in their attempt to sift out the fake pictures and give their readers only the real thing. Fake pictures and falsified captions probably will continue to pop up from time to time, and a few of them are bound to slip through into print as the truth. There is one consolation in the fact that editors and readers now are alive to the danger. All war picture releases, especially those of the Nazi Propaganda Ministry, now are subject to the closest scrutiny.—

Are You Improving?

(Continued from page 37)

I chose such subjects as seascapes, rural landscapes, trees, horses, church steeples, railroads, and public buildings, making certain that I could find the same places again, and that they wouldn't change from year to year. I kept accurate information on each—weather conditions, angle of sun, camera, aperture and shutter speed, film, filter, etc. I now have three pictures in each of 15 subject sets, but as time goes on I hope to have as many prints in each set as I have years in photography.

Maybe print No. 5 in the set on church steeples will land in a salon. Perhaps print No. 4 in the set on airports will be bought by a magazine editor. I may not be satisfied with No. 30 in the tree set, but I will know I have been working with a plan which makes success more certain.

Comparisons which are especially valuable can be made by setting up specific photographic problems and then solving them at yearly intervals. For instance, my favorite field is animal photography, but instead of using it as a whole for purposes of comparison, I decided to limit my efforts to one problem. I selected "shooting closeups of horses." Two accompanying illustrations, at the beginning of this article, are from this set of pictures.

Another problem I am trying to solve is "church steeples against the sky amid tree branches." The two main difficulties here are to avoid distortion in the steeple, and to get detail in the steeple and leaves and still show clouds in the sky. I think No. 3 in this set is really an improvement over No. 1, shown with it, but many possibilities still are left for the future.

No matter where you live, what degree of skill you already have, or how extensive your equipment, you will find that setting up problems and trying to solve them from year to year will make you more careful in all your photography. Suppose, for instance, you are trying to keep a picture record of the children, and the one special picture you took of Jimmy on your visit to Grandmother's house last summer didn't turn out as you had hoped. Wouldn't that make a good problem for you? Call it, "Jimmy on Grandmother's lap out in the summerhouse," perhaps. Try the same pose in the same place next summer vacation, and for several years. You'll have an interesting record as well as a means of comparing your ability in handling that particular problem.

Maybe you like to take pictures of lakes, or at the seashore. There probably is one tiny harbor, a peculiar rock formation, or an old boathouse that you return to again and again. For the harbor, your problem might be, "busy summer resort harbor on a sunny July day;" for the rocks, "waves dashing against the rocks in a strong wind;" for the boathouse, "storms and sun have beaten against the building but it is still strong."

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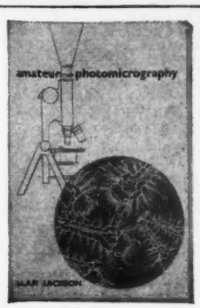

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suggest the ways in which you might go about getting pictures of it from year to year. It is an historic mill only a little way from your home, and since it is cared for by the historical association of your town, it will be kept pretty much as it is for years to come. So your first problem, that of keeping all factors constant, save that of your photographic skill, is solved. There is a small pond from which a narrow stream of water falls to turn the mill wheel, and rocks make a setting for the grasses along the edges of the pond and stream. The mill itself is of weathered shingles, and is set under two tall maple trees. There is an old stone wall running parallel to the stream, with an antique lamp post at the gate. You can visualize the many picture possibilities in so rich a photographic subject.

Your first attempt to capture the beauty of this picturesque spot will probably be a view to include everything—mill, pond, stream, wheel, wall, and trees. If it is your first year in photography and you succeed in getting a well-exposed negative, sharp enough to enlarge, you are doing fine—better than I did, I might say. During the winter months which follow, you will have read and studied, and practiced picture taking. By the second summer, you will realize that the best pictures are most often those which emphasize some one phase of a subject in such a way that the feeling of the whole subject is presented. So you visit the spot again, on about the same date and with the same weather conditions, if possible. Remember that you are aiming to keep but one variable in your comparison—that of your own changing skill. Should you have changed cameras, exposure meter, brand or type of film, or other equipment, be sure to make note of that fact. This time, the water splashing over the wheel gains your attention. Since you are now more experienced, you study the speed of the water. You note the difference in exposure needed by the water-soaked wheel and the sun-brightened water before you decide what combination of aperture and shutter speed to use. Also, you try various speeds to show the moving water best. Chances are, your shots are quite successful. You can see for certain that you have made a considerable gain over the first year's picture.

The third summer comes. This visit to the old mill should yield even better results. You decide to try some foreground framing, perhaps using the old lamp post and one of the trees to give perspective to the building in the background. Then your problem is one of focus—shall the lamp post or the mill be sharp, or shall it be both?

Perhaps you are attracted by the reflection of the stone foundation of the millhouse in the quiet pond. Here you must solve the perplexing problem of which shall be the principal object in the picture, the object itself or its reflection. Do you see how this one, isolated picture setup can be made to serve for as many years as you wish, yielding many different problems for you to solve? By comparing the results of each year's trials, you can see clearly what progress you are making—not only in technical skill, but also in your ability to see and compose a picture.

Of course, all during this time, you will have kept an accurate and detailed record of weather conditions, photographic equipment, and exposure data. And you will have made up the best possible 5x7 or 8x10 enlargements of each year's shots, filing them with the recorded data in such a way that comparison with those of the following years will be convenient and easy. Such a system will be well worth your trouble.

Here are some subjects which you will be likely to find waiting for you, no matter where you live—city or village, mountains or plains, shore or inland, north or south, east or west: monuments, public buildings, railroad stations, Main Street, your house, your yard, your adult friends and relatives, your child friends and relatives, pets, churches, schools, historical spots, and natural wonders. There are many others of a general nature, and there are still more that will be peculiar to your particular location—lake scenes, water sports, river and lake transportation and commerce, salt water transportation and commerce, sheepherding, cotton growing, cattle raising, mountain scenery, and regional architecture, for example. For each of these subjects, you will quickly find photographic problems which you yourself are immediately interested in solving to the best of your ability.

It is obvious that if your prints are to show improvement from year to year, you must do more than take dozens of pictures between times. Practice is a good thing only if some thought is put into it. Where can you get some thoughts to help you? Read the photography magazines, study books on photography, attend photographic exhibitions, discuss photographic problems with experts, and go to your local camera club and take an active part in club competitions. Experiment with new ways of photographing everyday subjects. Then, from time to time, enter regional and national competitions, and compare your photos with those that won the big prizes. File all the negatives that you take during the year, classifying them according to subject matter. Then you will be able to see the intermediate steps you have taken to achieve a truly fine picture—one that may be No. 4 or No. 14 in your series on a particular subject.

If you want to keep on getting better pictures, recording your progress as your work improves, give this plan a try. It works for me. It will work for you.—▶

Non-Warping Shelves

MANY readers must have encountered trouble from their darkroom shelves warping when water or chemical solutions were spilled on the wood surface. I found that if the entire top surface of a shelf is coated with melted paraffin wax, and the latter allowed to "set" thoroughly, any subsequently spilled water can be wiped off and the shelf remains as good as new.—*Ed. Cloonan, Jr., Normandy, Mo.*

Covering America in Color

(*Continued from page 27*)

tography. Despite our rules, we must admit that many unusual pictures have been made in cases where they have been broken. Often a situation which appears most difficult to the photographer will yield amazing results if he meets its problems with all the knowledge and ingenuity at his command.

By this I mean far more than photographic knowledge. There is little information in any field that will not be of value some day, somewhere, to the photographer whose ambitions are wide.

Even a knowledge of the habits of bees, for example, can help the color photographer get better pictures. Suppose you see a beautiful blossom, and would like to show a bee perched upon it. Simply dissolve a little honey in water scented with a drop of perfume, and spread this mixture on the petals. You'll not have long to wait before your subject will wing his way to the feast, repaying your thoughtfulness by adding interest to your closeup of the flower.

An old rule for color shooting is never to take a picture with part of the subject in sunlight and part in shadow. Yet, sometimes you will want to break this rule. I have done it again and again, firing a blue, daylight-type flashbulb on an extension to light up the shadow area.

Green often photographs darker than it appears to the eye. The obvious way to avoid this is to expose for the green areas in the picture to make them lighter. But this is likely to overexpose the brighter colors. I recently photographed a setup combining oranges and green leaves. To get true color in both, the leaves were given more light than the fruit. That solved the problem.

Often, I'm asked about exposure—the thing that counts most in any type of color photography. I always answer, "Use a good exposure meter. Don't guess at anything. Don't be afraid to make more than one exposure of the same subject. Sometimes that's the only way to make sure of one perfect picture."

Overexposure will wash out all colors, making them appear lighter and weaker than they really are. Underexposure has the opposite effect, making them seem darker and more intense.

I usually underexpose pink, light blue, and yellow. I overexpose dark red and green. Where there are objects of many different colors in one picture, they are lighted to give each one the proper exposure.

Of course, generalizations like these are all right as far as they go. But beyond them, each situation must be carefully analyzed and worked out by formula for the general rules covering each color.

In taking color pictures all over the country, I often was confronted with problems to which my general rules did not apply. Then each picture had to be worked out by itself.

To achieve proper effects in situations involving a constant variety of unprecedented problems, I had to devise many gadgets and improvise many methods of lighting, subduing light, and shooting under a combination of sun and artificial light.

In the mammoth plant of the Ford Motor Company at Dearborn, Mich., for example, the enormous glass walls of the workrooms gave an excess of daylight and prevented use of artificial lighting. Therefore, many operations had to be photographed at night. Where night shooting was impracticable, for one reason or another, we covered those huge windows with light orange cellophane in order to bring the daylight into balance with the artificial light required inside.

Where this expedient was not feasible, blue flashbulbs and blue floodlamps solved the problem. The entire staff of company photographers was placed at my disposal in the Ford plant, and they gave me understanding help in the detailed preparation of certain "shooting sets" covering as much space and involving as many people as the big productions of Hollywood.

To secure the dramatic effects of flaming liquid steel, we were permitted to climb to a precarious position atop the huge melting furnace. From this lofty vantage point, dodging the frequent showers of sparks that shot up about us, we set up the proper lighting and captured on color film the fiery animation of the boiling metal. In order to bring out the red hot steel in higher key, we subdued the surrounding area by giving it only a small flash and less than normal exposure.

Far from automobile factories, we boarded one of the large boats of the Gorton Fisheries for a three-day fishing trip out of Gloucester, Mass., to get a complete color picture story of America's important fishing industry. There was neither space nor current for any lighting equipment beyond synchronized flash, and many operations of fishing usually performed at night had to be staged by daylight.

Synchronized flashes proved adequate in portraying the galley, living quarters, and iced storage bins in the hold of the boat. To secure warmer colors, a very light filter was employed in many shots. Metal reflectors were placed at points where they would throw light into the shadow areas, producing more uniform lighting in the pictures.

With so many of the fishing operations performed from dories working at some distance from the mother ship, I found the telephoto lens extremely useful. Without it I could never have made the desired closeups of men baiting their hooks, pulling in the catch, or other pictures that added a salty tang to the collection. This fishing chapter alone brought up problems ranging from keeping destructive ocean spray from my cameras to photographing the cleaning of fish in a manner that would not offend good taste and yet would preserve realism.

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Many others, 6x9 and 9x12 cameras from $12-up. Ask for quotation.	

SPEED-GRAPHIC

Miniature Kodak 4.5 lens, $76.00; Tessar 4.5	$ 88.00
3¼x4¼ or 4x5 Anlv. Tessar 4.5	96.00
Many others slightly used and brand new—ask for quotation.	

ENLARGER

Leitz Valloy, 35 mm	$ 25.00
Solar 2¼x3¼, F:4.5, 3" lens, like new	24.50
Federal Mod. 219, F:6.3, $16.00; Mod. 331	7.00
Federal 606 with lens	63.00
Super Omega B	

LENSES

For Leica: 35mm. W.A. lens $49.00, 90mm. Elmar F:4 $59.00, Summar F:2 lens $46.00, Xenon F:1.5 $105.00, Elmar 3.5 $27.00, Thambar 9cm. F:22 $79.00, Hektor 7.3 F:1.9 $74.00, Hektor 135mm $63.00, Hektor 28mm. F:6.3 lens $48.00.
For Contax: Bigon 2.8 $99.00, Tessar 2.8FS $47.00, Sonnar 135mm. $98.00, Sonnar 85mm. chrome $129.00, Triotar 85mm. F:4 $62.00, Tessar 2.8/5cm. $34.00, Sonnar F:2/5cm. $42.00, Sonnar 1.5/5cm. $64.00.

MOVIE

8mm.

Revere 88, F:3.5, $24; F:2.5, $33; F:1.9	$ 48.50
Filmo Sportster, F:2.5, like new	45.00
Kodak Mod. 20, F:3.5	18.00
Revere Projector, latest	46.00
Kodascope 70	41.50
Cine Perfex Turret, F:2.5, Magazine Load	44.00
Kodak Mod. 25, F:2.7	26.00
Keystone K8, F:2.5	22.50
Magazine Kodak Mod. 90, F:1.9	72.00
Kodak Mod. 60, F:1.9, $46.00; Univex, F:5.6	4.00
Univex Projector P500, like new	24.50
Revere Mod. 99, F:2.5, latest	47.00
Keystone K8, Proj. 500W, latest	32.00
B. & H. Turret, F.2.5, Mod. 134B	58.00

16mm.

Cine Kodak Magazine, F:1.9	$ 73.00
Kodak Mod. K, F:1.9	49.00
Keystone A7, F:2.7	24.50
Keystone A 82 Projector, like new	48.00
Bell & Howell Mod. 70, F:3.5	26.00
B&H Mod. 121, F:3.5	40.00
Kodascope Mod. EE, like new	46.00

Many others, 30x40 Crystal beaded deluxe box screen, list $16.00—Special $6.75.

OTHER SPECIALS

Instruction booklets for your imported or domestic camera 25c.
Super Ikonta BX, latest $138; Super Kodak Six 20, list $260, $118; Watson View 4x5 Camera, F:4.5—5½" cpr., special, $45; Weston Master, $16.50; Dejur Critic, $9.50; Super Ikonta A, Tessar F:3.5, $53; Super Ikonta C, Tessar F:4.5, $58; Super Ikonta C Special, Tessar F:3.5, $85; 8x30 Zeiss Binocular, latest, $76; Plaubel Makina IIS, latest, special, $169; Argus C III and B&L Telephoto Lens, special, $38; Leica or Contax Loading Magaz., $2.10; Cases for All Type Cameras, $1.50 up. Wide angle—Telephoto Lenses and others from 2" up to 12" in stock—Write your wants.
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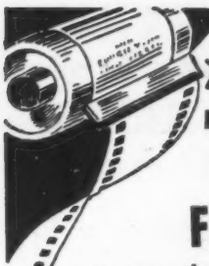

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railroads, began with a man buying his ticket and followed him on through his journey. The very first shot brought complications. No sooner had we set up our light at the ticket window than we found the camera facing a highly unnatural background. Attracted by the illumination, hundreds of people crowded around to stare at our model, conjecturing as to who he was and why he was being photographed. We were grateful when a policeman came to our rescue and closed the area to the public.

We were having trouble enough with our lighting problems. To begin with, the very high ceilings of the terminal required a slightly higher degree of lighting to secure proper exposure. Then, to avoid a dark area in the picture, we had to get more light at the ticket window. This problem was solved by removing the regular bulb above the window and substituting a floodlamp. When we photographed the man entering the railway car, we had to expose a half stop less to secure the effect of an underground terminal.

Dining-car shots, with contrasting and glaring subjects in close proximity, had to be lighted indirectly to avoid hot spots on the silverware. To solve the problem of the white tablecloth, which tended to be overexposed in comparison with the dark red interior decoration, we boosted the light on the walls and threw less on the table itself.

Even with the most careful planning, delays sometimes prove inevitable. Our plans all made, a train we wanted to photograph pulled into the siding, right on schedule but badly smeared and streaked with evidence of a snow storm through which it had come. The camera picks up every detail, good or bad, and there was nothing to do but wait while the railroad officials called a crew of men to give the train a thorough scrubbing.

It's well for the amateur color photographer to remember the three rules mentioned at the start of this article. Try first for closeups, rather than unwieldly long shots. Watch line and composition, and avoid conflicting colors. Shoot between nine and eleven in the morning and between one and three in the afternoon.

But it's also well to remember that there will be many times when these rules must be broken. When a whole picture setup should be made to appear lighter, slight overexposure will do it. When the entire scene should be darker, with its colors more intense, then slight underexposure is the answer. Filters can be used to give color correction for shots in the early morning or late afternoon, when sunlight contains an excess of red.

Where only a portion of the picture area must be made lighter or darker, or where it contains objects that require more exposure than the rest of the scene, controlled lighting provides the solution. Give dark objects more light, if you want them to show detail. Cut down the illumination striking light objects to bring them into the range of the rest of the scene.

No matter how difficult a problem may appear, it can almost always be solved by the photographer with ingenuity and perseverance. Given identical problems, a photographer with an abundance of these qualities and a minimum of equipment often will do better than a fellow worker who relies on expensive equipment alone to pull him through.

There's fun in color photography, even without an assignment to "cover America." The cameraman who is determined to get high-quality pictures that are of interest must solve each problem as it arises. He must work out the proper procedure for taking each picture, whether he is photographing a nesting bird in his own back yard or a mountain scene above the clouds.—■

Holder Aids in Loading Reel

THE simple roll-film holder illustrated herewith enables me to have both hands free for loading film into the reel of my developing tank. This makes the

Preparing holder for loading reel.

operation quicker, and reduces the danger of dropping film or reel on the floor. The device is simply constructed, as is apparent from the photo. To use it, remove the rod from the slots, insert it in the film spool, and replace the rod in the slots. Loading of the reel is carried out in the usual way.

Although the model shown is designed for use with 120 or 116 film sizes, a slight change can be made to accommodate other sizes. For best results the holder should be anchored to a bench or table so it will stay in place during use. —*Lawrence Edwards, Newhall, Calif.*

"Oh, don't try to look so innocent! Take it and get it over with!"

The Bachrach Secret: "Put Them at Ease"

(*Continued from page* 61)

tracting element to your photograph.

When the subject is posed on the grass or on a bench, then the picture must be taken from a high enough angle to avoid the sky. This matter of angle is one which the amateur is likely to overlook, with the result that portraits often show a dull uniformity which could be avoided by using a little imagination. Considerable interest is added by taking pictures from unusual angles.

The time of day for taking outdoor portraits is just as important as the background. The worst time is at noon, in bright sunlight. The intense light, shining directly from overhead, causes large pockets of shadow around the eyes. It is better to take portraits when the light is less intense, or with the subject in the shade.

An especially pleasing effect is obtained by working in the shade or under trees, with sunlight coming through the branches and falling on the hair. This is particularly good for photographing a girl or a child.

The matter of clothes is another important consideration, if you want to achieve the best possible effect. Plain clothes, of course, are always best. Dark clothes help to achieve contrast.

There are a few special rules which the Bachrach Studio always follows in photographing babies. First, the baby should be dressed in light, plain clothes, and never in shoes with hard soles. Such shoes make the feet look huge, particularly if the child is seated facing the camera. It is better for a small baby to be barefoot. The lighting should be such that there are no dark shadows in the picture. For indoor work with children, it is best to use at least two lights, placing them to avoid shadows, but at the same time making sure that they don't make the child squint.

One final suggestion from the Bachrach studio. If you want to get interesting poses and groupings, study the fashion magazines. Many such magazines have a flair for unusual and striking poses of individuals as well as of groups. It will well repay you to study such magazines, not necessarily with the idea of copying their arrangements but merely in order to give you a realization of the possibilities inherent in what often appears to be ordinary surroundings.

According to the Bachrach philosophy, portrait photography is a fine art, and deserves the same conscientious care as any art. This raises it considerably above the level of a craft, where mechanical excellence is the principal consideration.

Judging by results, this philosophy is a sound one, for Bachrach, Inc., is one of the largest photographic organizations in the world. Its story is an interesting one. The Bachrachs were the first to develop portrait photography on a large scale. Always before, portrait studios had been small, one-man affairs, and frequently they were conducted on anything but a business-like basis. This was due perhaps to the fact that the photographer was essentially an artist rather than a business man. David Bachrach, founder of Bachrach, Inc., combined the shrewd judgment of the business man with the professional pride of the artist photographer. He began a huge business organization whose product still retains its individuality.

In 1861, when he was about sixteen years old, David Bachrach apprenticed himself to learn photography. During the Civil War he obtained many photographs for *Harper's Weekly*, including one of Abraham Lincoln, taken at the time of his Gettysburg Address. After seven years' apprenticeship and practical experience, in 1868 he decided to start a little business of his own. The first Bachrach studio was on the fourth floor of an old building in Baltimore.

Interested in improving the technique, as well as the artistry, of portrait photography, Bachrach constantly experimented with processes and methods. As a result, the profession is indebted to him for many improvements. He perfected a process by which good prints can be made on painter's canvas. He also worked out a way of abolishing the troublesome process of toning with chloride of gold. This led to the production of various kinds of self-toning papers.

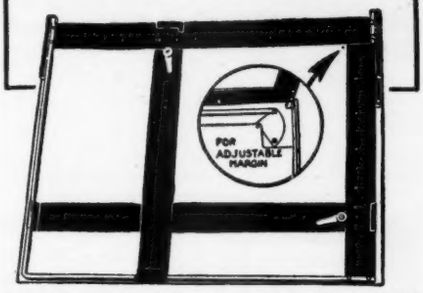
The two Bachrach sons, Louis Fabian and Walter Keyser, decided to follow their father's profession. They went through several years of apprenticeship with their father and also with several of the leading photographers of the day. In 1904, Louis Fabian Bachrach decided to start in business for himself, so he opened a studio in Worcester, Massachusetts. In the meantime, Walter Keyser Bachrach had taken charge of the studio that his father had opened in Washington in 1899. Before long, studios were opened in Philadelphia, New York, and cities in the Middle West.

The present head of the organization, Louis Fabian Bachrach, some time ago gave up making photographs himself. The third generation of the family is now in the business. One son, Bradford, is vice-president of the company and heads the East Orange, N. J., studio. Another son, Louis Fabian, Jr., is learning the business from behind a camera.

The finishing work for all the studios is done in a huge plant on the Charles River at Newton, Mass. Here the senior Bachrach himself inspects every single photograph that is taken. The fact that he once ran a studio in which he did all the work—photographing, developing, retouching, printing, selling, and bookkeeping—enables him to give every department expert supervision.

When he advises a young photographer, one of the first points he brings out is, "keep them at ease." Good technique is important, all through the process of making a portrait, but the mechanics don't mean a thing unless the expression is right.—

Bee Bee (all-metal) ENLARGING EASELS and MASKING FRAME



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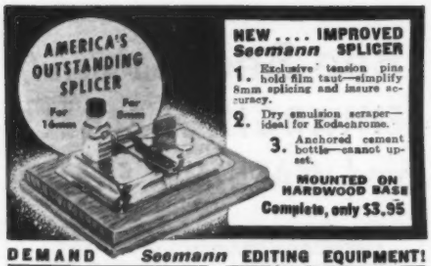

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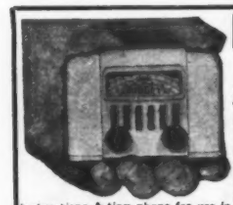

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Trade Notes and News

(*Continued from page 66*)

development of 30 rolls of 35 mm or B2 (120) film with no increase in developing time. For complete details regarding Finex, write to Agfa Ansco, Binghamton, N. Y.

SAID TO retain all the features of previous models, the newly announced Model ADB Miles Filmgraph in addition is entirely automatic in operation. A special version, known as Model 2-ADB, has a 2,000-ft. reel capacity. Information concerning these sound units can be obtained from Miles Reproducer Co., Inc., 812 Broadway, New York City.

JUST RELEASED, in 16 mm and 8 mm sizes, a movie feature entitled "America's Call to Arms" is the latest in the list of Castle Films headliners. The subject of national defense is covered from a variety of viewpoints in the new film, concerning which readers can obtain complete details by writing to Castle Films, Inc., 30 Rockefeller Plaza, New York City.

SUBSTANTIAL price reductions on the Joseph Schneider Componar enlarging lenses are announced by the distributor, Burleigh Brooks, Inc., 126 W. 42nd St., New York City, from whom details are available. The Componars come in a variety of focal lengths and are mounted in focusing sleeves with iris diaphragms.

INCLUDING A dual turntable system, 5-tube amplifier, 8" speaker with 40-ft. cord, and crystal microphone, among other equipment, the Cine-Sound home recording and reproduction outfit sells for $89.50 complete, and has been developed primarily for use by movie makers. Full information converning Cine-Sound can be obtained from the Cine-Sound Co., 6208 W. Cermak Rd., Berwyn, Ill.

FEATURING A non-deterioration principle whereby actual production of current commences only after a seal on the bottom of the casing is given a sharp rap, Triumph dry cells list at 10c each. These batteries can be stored indefinitely, it is claimed, until actual use is desired. Full information regarding them is obtainable from Triumph Battery Co., Elkton, Md.

A COMPLETE LINE of loose-leaf photographic albums, consisting of binders and Mikafilm envelopes, is made under the trade name of Ful-Vu by Cook's, Inc., Camden, N. J. Literature describing Ful-Vu products can be obtained by writing to Cook's.

AN INSOLUBLE, lintless paper which facilitates the drying of negatives by absorbing all surface moisture, Textilex is put up in rolls and sheets for drying roll film and cut film or filmpack negatives, respectively. For prices and other particulars concerning Textilex, write to Raygram Corp., 425 Fourth Ave., New York City.

DEFENDER PHOTO Supply Co., Rochester, N. Y. now offers a line of card-mounted gelatin filters designed especially for use with Varigam enlarging paper. They are available in two sets of 5 each at $1 per set, and a complete outfit of 10 filters at $2. The same gelatins soon will be available in metal ring slip-on holders, it is said. Write to Defender for further details.

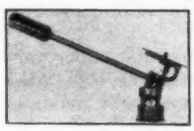
A FREE BOOKLET on enlarging has just been published by Burke & James, Inc., 223 W. Madison St., Chicago, Ill. Readers of POPULAR PHOTOGRAPHY can obtain copies by writing to Mr. S. Drucker, in care of Burke & James, at the above address.

USING NO more current than an ordinary house bulb, the Ilgvent ventilator is a small-size unit designed largely for use in home darkrooms and small studios. Other models also are available, and complete information regarding the line can be had by writing to the Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.

AMONG THE NEW items placed on the market by Camera Cases of Hollywood, 6513 Hollywood Blvd., Hollywood, Calif., are cases designed specially for Speed Graphic cameras and accessories. The new type of case is equipped with a top which opens in halves, permitting the camera to be carried with flash synchronizer already mounted for instant use. Space is provided for all accessories. The case for the Miniature size sells for $11; the model for 3¼ x 4¼ and 4 x 5 cameras retails at $13.50.

PRICE REDUCTIONS have been announced in the line of Zephyr blowers, used for darkroom ventilation. The single-unit model, which formerly sold for $9.95, now is priced at $8.85. The double-unit model, which can be used for ventilating two rooms, has been reduced from $18.50 to $13.50. Further information can be obtained by writing Pacific Photo Distributors, 1012 S. Olive St., Los Angeles, Calif.

HAVING ASSEMBLED sufficient raw materials to meet the anticipated demand, Camera Specialty Co., 50 W. 29th St., New York City, announces that production is in full swing on two Caspeco pan heads. Nickel-plated brass construction and positive action characterize both models, the E-Z Pan Head selling for $2.95, the De Luxe Pan Head for $3.75. For further details, write to Camera Specialty Co.



Caspeco Pan Head.

A NEW MODEL of the Photrix Print Washer, to accommodate prints up to 11 x 14" in size, is announced by Intercontinental Marketing Corp., 95 Madison Ave., New York City. The 11 x 14 model lists at $5.95, the 8 x 10 model continuing to retail at $2.95.

PRODUCED IN cooperation with the United States Navy, a new film entitled "Our First Line of Defense" now is available in five standard lengths in 8 and 16 mm. Details concerning the new film can be had by writing to the producer, Official Films, Inc., 1441 Broadway, New York City.

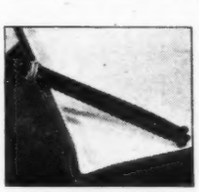
A LEAFLET describing the speeding-up of film processing and printing includes formulas for a 2-minute double-solution developer and a 1½-minute fixing bath. Complete directions for processing, drying, and printing a negative within 15 minutes are contained in the leaflet, copies of which can be obtained from Wabash Photolamp Corp., 335 Carroll St., Brooklyn, N. Y. Also announced by Wabash are two new blue-coated flashbulbs for color work, the No. 0B, selling for 16c, and the No. 40B, which is priced at 20c.

SAID TO BE IN many respects superior to the Rapidon model, which it replaces, the new Master Footswitch features a live rubber housing, 1,500-watt capacity, and three electrical outlets. Slight pressure anywhere on the surface of the housing will operate the switch, it is claimed. The Master retails at $1.95, and is manufactured by Key Products Co., 636 Eleventh Ave., New York City.

SIMILAR TO THE revolving and tilting tripod head built integrally with the Graphic View camera, the new Graphic Pan-Tilt Tripod Head has been announced by Folmer Graflex Corp., Rochester, N. Y. The new accessory tilts 100° forward and 25° backward, and rotates a full 360°. Further details concerning it can be obtained from Folmer Graflex.

Keeps Tongs from Slipping

BY merely twisting a rubber band about the end of your print tongs, you can keep them from slipping into the trays of developer and hypo in which they are used. The purpose of the tongs is to keep the hands dry and to avoid carrying one solution over into another, and it is a nuisance to have them slide down into the tray where they have to be fished out with the fingers. This can be prevented by using rubber bands, as shown.—*Paul Stiles, New Bedford, Mass.*



Non-slip tongs.

Campfire Movies

(*Continued from page* 51)

with some stopping down of the lens.

Burn a short length of the ribbon, and time it with a watch. From this test you can calculate the amount necessary to film a certain scene. Remove only this much from the roll, and keep the rest under cover.

A piece of bright tin, in which is punched a small hole, is of tremendous aid in directing the greater part of the light in the right direction. At the same time it shields the camera lens from flare. Run the end of the ribbon through the hole in the tin before igniting it. The ribbon then can be fed through by an assistant as it burns.

Caution your actors against looking directly at the burning magnesium. If they do, they'll see spots before their eyes for several minutes.

For closeups, and other scenes in which no view of the fire is included, you won't need to keep the magnesium in the flames. When burning, it has a habit of twisting and turning about. This will tend to create a firelight effect, as the highlights and shadows are continually changing.

Caution the person handling the ribbon against letting any of the hot ash drop on his hands or clothing. It can inflict painful burns.

As with all types of illumination, the strength of the magnesium light diminishes rapidly as the distance from it to the subject is increased. Don't try to light up much more than a full length figure with it. An exposure meter will tell you if you have enough light for filming. Take the reading directly from the skin-tones. If it calls for a stop or so more than your camera lens will give you, shoot the scene anyway. Slight underexposure will help produce a convincing effect.

When using flares for campfire pictures, make sure everybody knows what he is supposed to do, and make doubly sure of your camera angles before striking a match. Unless you do this beforehand, you will waste much of the time the flare burns, and run your expenses up.

Fasten a piece of bright tin to a stick, and tie the flare to the stick before lighting it. This assembly can be stuck into the ground close to the campfire. After the flare is lighted, it needs no further attention.

Since the campfire is supposed to supply the light source in your movies, keep the flare right on the ground. If you back up to take a long shot which includes the fire in the scene, have a person sit between the bright light and the lens. Remember what happens when you shoot at the sun without a sunshade, and think of the artificial light as only a miniature sun.

Flares are useful for other types of camp movies. You might build the fire on the shore of a lake. Shoot out over the dark waters as one or two members of the party paddle a canoe toward shore. The effect of the craft gradually coming into the light out of the dark packs a tremendous wallop. For variety, take the camera out in the boat and film toward shore. Silhouettes and the dancing firelight on the water make an inspiring scene. Flares also are well adapted to many other types of night filming.

A third method of lighting camp pictures was used recently by a friend of mine. He disliked magnesium for the purpose, as he was filming within a tent. Instead, he employed two gasoline lanterns. The white interior of the tent served to reflect the light, and his movies of his companions preparing for bed, and rolling up in their blankets were very satisfactory. His final scene showed a closeup of the lantern itself, as a hand reached in and shut off the valve, thus providing a novel fade-out.

Even a short campfire sequence helps out any camping movie, so next time you head for the wide-open spaces, try capturing some by the methods described here. And when you get back home, if you've missed a certain closeup, just build a fire in your back yard, bury a floodlamp in a reflector next to the fire, and run an extension cord to the nearest light socket. A tree branch waved before the reflector will help give "firelight" lighting to closeups. If you don't let them in on the secret, your audiences will never know the difference.—■

Practical Infrared

(*Continued from page* 35)

other, and you are all set from then on.

In focusing, there is one factor which must be considered. Infrared radiations, being of longer wavelength than visible light, are not bent as much in passing through the lens. Therefore, they come to a focus slightly *behind* the plane in which the visible light rays come to a focus. To compensate for this, the bellows should be extended about two per cent of the focal length of the lens to bring the infrared into focus sharply in the plane of the film. This is also a matter for experimentation. When you have made your exposure tests, follow with a test for focus. With most lenses having a focal length of seven inches or less, good definition is secured at full aperture without making this compensation—again due to the characteristics of the lens. But a shot taken with the bellows normally extended, followed by one with the bellow extended an additional two per cent of the focal length of the lens, will show definitely whether you must make the compensation with your camera. Some lenses have a red dot on the lens barrel to indicate how far the lens should be extended for infrared work.

With these preliminaries out of the way, you are all set to get down to business. Let me caution you always to use a tripod or to have your camera resting on a solid base. When you are shooting at 1/25 or 1/10 second, the more stable the camera the less chance there will be of having blurred pictures.

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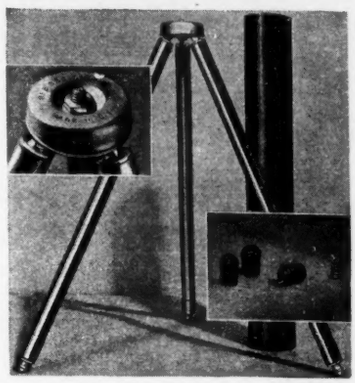

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ferent from any other pictures. Let's investigate them, one by one, at the same time referring to the accompanying illustrations.

Haze Penetration. The long infrared waves cut through atmospheric haze like a hot knife through butter. Hills and distant horizons which, when photographed on panchromatic film, appear indistinct, are rendered clear and sharp. The bluish haze which ordinarily flattens background detail in landscapes disappears in infrared photographs rendering detail in the distance. A good example is the shot I made of the length of Death Valley. Details at the far end of the Valley, and which were almost invisible to my eyes because of atmospheric haze, show clearly in the print.

Mind you, though, I speak only of *atmospheric haze*. A lot of fairy tales have sprung from unknown sources to the effect that infrared will penetrate *fog*. This is not true. Fog is a precipitation of moisture in the air, just as clouds are, and the photographic effect on infrared film is the same.

Sky Rendition. The sky in infrared pictures comes out very dark. Near the horizon it may appear lighter, due to infrared radiation from the earth. But the clear, blue sky itself is relatively free of infrared reflection or radiation, and thus appears dark on the print. It is important to have the sun at your back because of the concentration of infrared in the sky area near the sun. If you shoot into the sun, you will get light skies.

Cloud Rendition. If you have striven for beautiful white clouds against a black sky, infrared is one of the solutions to your problem. Clouds reflect a great deal of infrared and come out glistening and white. The wispy, feather-like clouds that are high in the sky and which are so difficult to catch otherwise, will usually be recorded faithfully on infrared film, contrasted against the dark sky.

Rendition of Trees and Grass. The leaves of deciduous trees (that is, trees that shed their leaves annually) reflect infrared rays to a high degree, and thus are rendered very light on the print. Grass and shrubbery records in the same manner, so that they sometimes take on the appearance of being covered with snow. Coniferous trees (the evergreens, firs, etc.) absorb most of the infrared. Therefore, they appear dark on the print. Where a landscape contains both types of trees, their portrayal in infrared is striking.

Rendition of Water. Infrared rays are absorbed also to a high degree by water, so it is usually rendered dark. The exception is when sunlight glints from the surface of the water or is reflected from spray. These areas are rendered light in the print.

Shadows. Little or no shadow detail appears in infrared pictures. Shadows reflect little infrared, so they appear quite dark.

The combination of these distinctive characteristics in infrared pictures renders a dramatic, bold effect such as is obtainable in no other way. Striking moonlight effects, particularly of seascapes, can be obtained by making the print just a bit darker than normal. If you keep the above characteristics in mind, you will have little difficulty in selecting appropriate subjects for your infrared work. The best results will be obtained on bright, sunny days when infrared radiation is at its maximum and shadows lend their aid in adding contrasts to the picture.

Landscape work, with which we have dealt almost exclusively here, is the most readily adaptable field for amateur work with infrared. There are endless applications of infrared photography in other fields, but most of them are in the realm of science and are outside the province of most amateurs. But for you and me, the greatest thrill will come from the stirring pictures we can get of the great outdoors. Regardless of where you live, you will find some suitable subjects for infrared.

When I speak of landscapes, I don't necessarily mean only fields, forests, mountains, and bodies of water. The works of man—bridges, dams, statues, building—all these and more can be photographed to advantage with infrared. And their portrayal in this manner will give you something different from that which you have achieved before, even with color filters.

In my own case, the unusualness of infrared pictures has borne excellent fruit. One shot, a picture taken from the top of the south tower of the Golden Gate Bridge in San Francisco, was selected as a cover for *Life* in competition with a number of other photographs—some of them submitted by professional photographers. Other of my infrared shots have found their way into *Business Week*, *Travel*, house organs, and the roto sections of newspapers. When you submit and infrared picture to an editor, you can rest assured that it will receive more than the minimum of attention just because it is unusual and eye-appealing. If you have paid attention to composition and the choice of your subject, you may be reasonably sure that you have a winner.

Now all there remains for you to do is load up with infrared film, get a deep orange or red filter, and go to work. But before you do so, it would be well to take your camera to your dealer and have him check it for infrared work. Most cameras nowadays are ideal for it. But there are some, particularly the older ones, which may have bellows which are not opaque to infrared. Some of the composition shutters and filmholder slides also are not opaque to these rays. If you want to find out yourself, load up and just expose your camera to the sun for a few minutes, develop the film, and if there is any fog noticeable on it, you'll know it is probably from one of these causes.

As for processing infrared film, the procedure is no different from ordinary developing, except that you should handle it in total darkness. Proceed as with any other film, and use your pet developer or that recommended by the manufacturer.

Wherever you take your vacation this summer, or even on week-end photographic excursions, make it a point to try infrared. Here's luck to you—and I hope that you enjoy it as much as I do.—▶

Focus on the Farm

(*Continued from page 31*)

flesh. He likes to have his equine talent appreciated—and who can blame him?

There isn't anything that takes more patience than photographing livestock. Take a herd of cows, for instance. There they stand, pretty as a picture, as you gaze at them through the viewfinder or look on the groundglass. But the minute you approach them, they take on the predatory stare and get set to run.

A try for a close-up usually brings their hasty retreat to a distant fence corner, or else they get so chummy they want to find out if camera leather has any salt taste in it.

I wasted several negatives before it dawned on me that a few cows lowing away the hours in clover make a much better picture than a whole platoon of cows. Do take time to compose your picture, if possible, or it's going to be funny. One cow will look as if she has eight legs or a quartette of ears.

Take a flock of sheep, either black or white ones, and they'll run like scared rabbits the minute you approach. They just don't like strangers. If you want a sheep picture, take a member of the farm household with you. Sheep know their "home folks," and your own presence becomes secondary. You can go ahead and shoot your picture with no trouble at all.

The most stubborn farm animal to get on a negative is a pig. On land or sea, there just isn't an animal more stubborn than a pig. Did you ever see anyone try to drive a pig? Anyone who proposes to get a pig to go somewhere else will usually be seen holding food out before it. That is, if he knows his pork chops on the hoof, that's the way he does it.

The best time to photograph hogs is when they're being fed, or after they've had a full meal. Filled to the jowls, they're mobile and languid as three-year-old hens at moulting time.

Lighting has as much to do with securing good pictures of animals as it does with getting good movies or pictures of humans. Out on the farm, with landscape stretching as far as the eye can see, there is much opportunity for artistic effects. Early morning or late afternoon will give oblique lighting, making a picture much more attractive than if lighted directly from overhead. Don't shoot at noon.

The field of farm photography is not overcrowded, and the subjects are legion. There are plowing and planting, by tractor or the "Giddap Champ!—Go 'long, Jess!" method. And there are haying and harvesting, corn-cutting and silo-filling, and threshing crews—at work or at mealtime. What a picture they make for tired old eyes, or keen candid-shot ones that aren't so tired!

From earliest springtime, when the first snowdrift starts to sag along the fence row, till the dews and damps of tardiest autumn, there are farm pictures galore. From early morning when the over-alled farm lad leans over the barnyard fence and calls: "Su-calf! Su-calf! Su-calf!" till day is done and the cows come home, there are interesting subjects to be snapped.

Take your choice. Scenics, human interest shots, farm animals, pictures of the dozens of utilitarian tasks around a farm—they are yours for the taking.

No field of photography is more soul-satisfying. There is a contagion about taking farm pictures that will not let you rest. You strive for more and more—and better and better ones. That habit alone is a commendable one for any photographer.

Farm photography does not require a camera with a super-fast lens. I have yet to use the *f* 3.5 aperture or the 1/500 second shutter speed on my camera in taking farm pictures. I think a reflex is especially suited to them, for composition is easily checked on the groundglass. Moments are precious, and any camera with which you are familiar enough so that you can work fast and smoothly is the one to use.

Out beyond the city's smoke and dust, summer months bring clouds that are extravagant in their beauty. Few landscapes can be made attractive without clouds, and often they make the picture. Personally, I much prefer panchromatic film for farm pictures. With filters, it renders clouds of striking clarity, and also permits using smaller diaphragm openings so desirable in making close-ups and shots in which minute detail is wanted. Too, it permits taking pictures later in the day than ortho film does.

A lens shade is a necessity to keep the sunlight from striking the lens. A yellow, orange, or red filter will be needed to register the clouds which you will learn to watch and study with ever-increasing interest.

An exposure meter is an enormous help in taking farm pictures. A relentless sunlight striking dark machinery, bright tractors, green grass, calico cows, ripening grain, and bronzed farm hands, makes guesswork difficult.

Dust in the country, especially at harvest time, is thicker than warts on pickling cucumbers—pollen, dust in the air, and dust underfoot. Your camera will require diligent care. Be cautious when you wipe the gritty dust from your lens or filters. I always carry a little camel's hair brush and some lens paper, and use the brush several times during a series of pictures. After every roll or so has been exposed, give the inside of the camera a good cleaning. An ear syringe and a bunch of pipe cleaners will perform the trick nicely. A camera will pick up more dust in one day's shooting on a farm than in a year taking still life pictures.

Here's another tip for you, gals and women, though it isn't strictly photographic. Wear comfortable clothing. Don't wear that flowered organdy dress because it's cool and the mercury is rushing up the thermometer. And don't wear high heels or something with the toe leather missing. You never in your life

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stepped or sat on a tack that was any sharper than bearded wheat. Fields and roadsides are full of pebbles, and they won't tickle your feet any. Your silk hose, too, will get more runs than a home-run champ in his best year. Slacks are the ticket, if you like them. Combined with a sport blouse, you have ample pockets for camera gadgets. Just don't overdress! The more you look like a farm person, the better you get along. The animals aren't so flabbergasted—neither are the farmers!

Whether the farm you visit is pretentious or a plain little one out at the cross-roads, life there is bound to be refreshing, busy, and full of purpose. A purposeful life—a farmer's life—can't help but produce good picture material. It's there, and it's yours for the asking. Go out and put it on film this summer.—►

Housewife

(Continued from page 53)

ment, by arriving, disheveled and garbed in her photographic work-togs, just as a much-surprised hostess was serving lunch to her distinguished guests.

On another occasion, when strikers from a lumber camp were on the march, she ran ahead of the men and photographed them at considerable personal risk while she walked backwards. Once she rode 40 miles out on white-capped Lake Superior in a boat to photograph a Chicago doctor engaged in deep-sea fishing, and lost her purse and her filmholders, beside getting seasick.

Slowly but surely, her news and human interest pictures began popping out in the Detroit *News*, Detroit *Free Press*, Milwaukee *Sentinel*, New York *Times*, Philadelphia *Inquirer*, Denver *Post*, and Los Angeles *Times*. Various picture magazines accepted her work. And recognized salons in Milwaukee, Chicago, and Detroit hung Keeton prints.

Income from picture sales and special assignments went back into the purchase of more materials for the home studio, and today Mildred Keeton has a really formidable array of photographic equipment. For her news work she uses a Speed Graphic and a Graflex. A Contax, fitted with an *f* 2 lens, is kept loaded with Kodachrome. Formal portraits and other interior work are done with a Korona View camera, while the bulk of her general outside work is handled with a Rolleiflex. The Keeton pantry darkroom houses two enlargers, a 5 x 7 Elwood and a Simmon Omega, as well as a home-made contact printer. A flash synchronizer and many other accessories complete the list.

Children and old people are Mrs. Keeton's favorite subjects for portraits, principally because they are always at ease, never posing. She's made many closeups of grizzled fishermen and wrinkled old ladies, but one of the best camera subjects she ever found literally knocked at the door one day, requesting permission to rake the leaves in the yard. After the yard was slicked up, she asked the old fellow into her home for a meal, and noticed the strong character lines in his face, which suggested good picture possibilities. While she was setting up her lights he fell asleep, and the resulting picture brought a nice check from one of the dailies.

Once when an out-of-towner dropped in for a sitting at her home, she switched on her lights, took the portrait, and went into her darkroom to develop the negative. When she turned to come out, the catch in the door-lock refused to work, and for more than an hour she yanked, pounded the door, and yelled for help. The much-distressed client finally called the police, and Mildred Keeton made a hurried descent through the window down a fireman's ladder.

What suggestions would a typical housewife who is making a success of photography right in her own home town have for other amateurs who are just experiencing their first shutter-clicking thrills?

"First of all, don't ever get discouraged," Mildred Keeton advises. "Start out with the best equipment you can afford, and you will increase the fun of trouble-free picture making. In planning portraits, don't try that look-pleasant-please stuff, for the average person poses entirely too much. Snap your subjects just as they are, and your pictures will look far more natural."

Children under three years old make very good subjects, Mrs. Keeton thinks, but those ranging from eight to ten are almost impossible. 'Teen-age youngsters are less difficult to handle, but old people are photographically ideal. Most of them want every interesting line and wrinkle to show in a portrait. As one elderly lady said to Mrs. Keeton, "Don't try to make me look young—I want to look my age!"

"Study and learn the proper use of your camera," this housewife advises, "and don't try to crack all the salons during your first year. What's more, don't ask me what constitutes a good salon print. Sometimes I can't understand the judges myself, for one group will accept a picture another has turned down.

"When women like myself pass middle age they often become unhappy because they haven't enough to occupy their minds. With their children grown and leading lives of their own, such women believe themselves no longer useful. They lack a purpose in life, something to work for. Photography has proven to be the answer to this in my case. In fact, in a large sense, photography has been our family's salvation."

Obviously, not every woman of Mrs. Keeton's age could hope to make such a thoroughgoing success in photography as she has. But it stands to reason that if one busy housewife and mother can reach the heights this one has, just about anyone in the same boat can find at least a great measure of personal enjoyment in the same hobby. So, when the kids leave home for school or work, and the house seems empty and time hangs heavy, Mother ought to purchase a camera and learn to use it. She might not make the salons, but she'll have a lot of fun!—►

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• • •

GRAPHIC GRAFLEX PHOTOGRAPHY, by Willard D. Morgan, Henry M. Lester, and contributors. Third (1941) edition. Published by Morgan and Lester. Cloth, 7½x10, 432 pages, illustrated, $4.00.

Originally announced in this column in April, 1940, *Graphic Graflex Photography* is now in its third edition. While minor changes and corrections have been made throughout the entire volume in order to bring it abreast of the current status of latest equipment, the more substantial additions include two new chapters: "Improved Perspective With the Graphic View Camera," by F. S. Lincoln; and "Personnel Identification Photography," by James J. Liccion.

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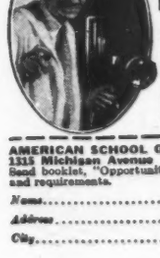

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Copyright Your Pictures

(Continued from page 59)

to a newspaper or magazine, this may not constitute publication.

This is a very important point under the law. If you wish to copyright your photograph, you must comply with certain rules *at the time of publication*, which may be before the copyright is obtained. If you publish your photograph without taking these steps, you relinquish all rights to it forever. It isn't any more yours than if you'd never made it.

Let us see the proper way to do this. You have already obtained your supply of registration forms from the Washington office. You will notice that they are simple forms, with less than a dozen questions. They are of two types, one for published photographs and one for unpublished pictures.

You have just made a shot which you prize very highly and believe will bring you some money. To protect yourself, you decide to copyright it, and you want to publish it right away. The first thing you must be sure to do is to put the copyright symbol (a "c" in a circle), your initials, monogram, or symbol, and the date on every copy you print. The best way to do this is to use a fine brush and some opaque paint to letter this on the negative, some place at the bottom or in a corner where it will show without spoiling the picture.

Failure to have this copyright notice on the face of your published picture means that you are dedicating it to the public, and that you will not be able to copyright it subsequently.

When the notice has been affixed and the photograph has been "published," you should fill out the application for registration which you have obtained from the copyright office. On this blank, you give your name, address, the country of which you are a citizen, the title of the photograph, and the date on which it was "published."

Accompanying the application, you must send two copies of the photograph and the copyright fee. This registration fee is $1.00, but if you want a copy of the registration scroll you must send $2.00. Your name and address and the title of the photograph must be written on the back of the picture. It isn't necessary to get a fancy title. If you can't think of anything special, just describe the picture simply as "Street Scene in Chiacgo," or "Elephants in Flight," or whatever it is. There's nothing to prevent your changing the title later.

When you have done this, you can sit back with the assurance that your rights to the picture are protected for 28 years—and can be renewed at the end of that time. If you sent $2.00, the Register of Copyrights will mail you a fancy little certificate which proclaims to one and all that you are the copyright owner.

But perhaps you have made a photograph which you don't want to publish immediately. You may want to hold it for publication in some magazine six months later, or to sell it as an idea for a Christmas card next year. You are afraid someone else may get the same idea and beat you to it. There is provision in the copyright law for your protection. You simply fill out the form for "unpublished" photographs, send $1.00 and one copy of the photograph to the Register of Copyrights, and your picture is safe. You get the same protection as though it had been published.

When your photograph reaches Washington, it goes through a careful process of registration—which is for your benefit. Copyright examiners look it over and study your application. If they discover that you have filled out the blank correctly, and that your photograph is indeed a photograph and not a blueprint or etching, they will enter it and send you Certificate of Copyright.

The examiners have found that the most common error photographers make is to publish the picture without the copyright notice. Then they discover that it is worth copyrighting, and decide to send in an application. It's too late then, and examiners are constantly being forced to refuse copyright certificates to photographers who have made this blunder.

The Certificate of Copyright is prima facie evidence that you own the rights to the photograph. It does not prove conclusively, however, that no other photograph of the subject exists. Thousands of photographs come in every year, and the Copyright Office is not equipped to make a search of its files every time a new picture arrives, to make sure there is not another one like it. In this respect, a copyright is different from the patent which is issued on an invention. The Patent Office makes a search to determine whether anything like the invention has been sent in before. If it finds that no such device has been patented, the inventor is granted all rights. The copyright office merely is able to testify that on a certain date, you sent in a certain photograph which you said was original. If anyone contests your ownership, you can produce the copyright certificate in court as strong evidence of your ownership. If the other party to such a suit has not been able to produce a certificate of earlier date, your copyright becomes very convincing.

You are entitled to take court action if you see a photograph which you have copyrighted being used by others without your permission. If your suit for infringement is successful, you are entitled under the law to collect from $250 to $5,000 statutory damages—or even more if you can prove that your own loss, due to the infringement, exceeds that amount. The statutory damages are yours, whether you prove any actual loss or not.

In case it is a newspaper which is guilty of the infringement, the law provides that you may collect only $50 to $200 statutory damages, unless you can

prove that you actually lost more than this—in which case you can get a part of any profits the paper may have made from the picture.

For your own protection, it is a wise idea to be familiar with certain aspects of the operation of the copyright laws. For the copyright not only extends protection to the photographer, but in some respects it exercises restraints upon him.

The laws provide that under most circumstances, the photographer himself owns all rights in the picture. But there are some cases where the photographer who takes the picture may not own the copyright. For instance, if a photographer sells a copyrighted picture to a newspaper or magazine, that periodical usually stipulates that it is buying the copyright. Then, if the photographer attempts to sell or use the picture otherwise, he is infringing on the periodical's copyrights and can be sued for selling his own picture. Of course, in selling a picture, the photographer can always reserve the copyright for himself.

If a cameraman is hired to make a picture, the person who hires him to do the work—and not the photographer—owns the copyright. Thus, portrait photographers do not own the rights to pictures of their subjects, nor do commercial photographers own the rights to pictures of buildings or groups which they are hired to take. However, if you make a picture of some person or building purely on speculation, you own the copyright.

In one case tried under the copyright law, a photographer had been hired to make a photograph of a nude figure for a calendar manufacturer. He was paid for the picture and the photograph was widely circulated, meeting with great success. About two years later, the same photographer used the same model—in a slightly different pose—to make another picture. He put a new title on it and, hoping to capitalize on the famed beauty of the girl, offered the picture for sale. The man who had bought the original picture brought suit against the photographer for infringement of copyright. The cameraman's defense was not adequate and he was convicted of imitating his own picture.

Innocence—the claim that you did not know someone else had already copyrighted a certain photograph or did not know what his rights were under the law—is no excuse. This point was clearly established in a case involving a New England photographer, who had made a picture of a high school graduating class on a speculation basis. He copyrighted the photograph and had intended to sell it to individual members of the class. The students decided to publish the picture in their year book, and in preparing it for the engraver they blocked out the photographer's copyright symbol.

This action brought woe to several persons. An engraving was made for the year book by one firm. A local newspaper borrowed the engraving and reproduced it. The publisher of the year book also printed the photograph. When the photographer saw this, he brought suit, claiming that the publication had ruined his chances of selling many copies of the photograph. The engravers, publishers, and the newspaper claimed they were not liable because there was no copyright notice on the picture they saw. The judge said that the fact that they did not know the photograph was copyrighted was no excuse and found them all liable for damages.

Because of the complications which sometimes ensue in litigation of this sort, the copyright office is scrupulously careful in handling the material which comes to it. Examiners go over every photograph and application minutely. If there is any question about a photograph, they will hold it up. For instance, if the photograph is of a nude figure, the examiner may see the possibility that someone would consider that it was indecent and tending to corrupt the young and innocent. The question will be presented to a revisory board which meets every day and the board will decide on it. It is not possible to copyright indecent matter. If the board cannot agree, the question is carried up to higher officials. Possibly, the Register of Copyrights may have to make the final decision.

Once a month, a fine arts committee from the Library of Congress visits the copyright office to view the photographs, books, and other matter which has been sent in. Some of this material may be selected for the Library's permanent fine arts collections, and occasionally photographs are among the objects chosen for this honor.

It only costs $1.00 to copyright an entire movie, but if you want to copyright a series of stills in a "picture story" you must pay $1 for each print—or $2 each if you want certificates. Copyrights issued in the United States are good in Canada, under a mutual agreement, but if you want a world copyright it is necessary to take it out in Canada. That nation is a signatory of the Berne convention, which is an agreement between most of the large nations integrating copyright laws. The United States has never signed the convention.

The cost of copyrighting a photograph is not excessive, but it is large enough to discourage photographers from sending in every snapshot they take. There is not much sense in spending $1.00 to copyright a picture that may not bring more than two or three times that amount, but it really is worth while when you get a photograph that sells widely or at a high price.

When you are convinced that you have something, put the copyright symbol on your negative right away. Then send in the registration forms, and you'll know the picture is yours for keeps.—▶

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Create Distinctive Print Labels

(*Continued from page 54*)

whatever form you select, arranging the white letters on a black background. The finished label also will show white letters on black, unless you reverse the tones by making a positive transparency from the copy negative, using that to produce the final prints.

Alphabet-soup letters are small letters made of noodle dough. For five cents you can get enough to spell out a label as big as a newspaper page. Using a rubber-tipped pencil or tweezers to shift them around on a horizontal surface, spell out the words. The letters, being nearly white, usually are placed over a dark-toned sheet of paper or cardboard. However, you can paint them black with water color or ink, and then shoot them against a light background.

An interesting design is produced by arranging soup letters, characters from a titling outfit, or cut-out plastic letters on the surface of a print showing an appropriate scene. This background print should be light in tone, so data written on the label with ink will show. You can throw the background design out of sharp focus by supporting the letters on a glass sheet held an inch or two above the print by spools or wooden blocks. When handling loose letters of any kind, a vertical copying setup is almost a necessity. Enlargers that can be adapted for copying are ideal.

If you want to use type in your label, go to a printer, have the type set, and get several proofs on white paper. Select the most perfect proof, add a photographic design or scene if you desire, and make a copy negative. Another way is to make up a number of photographic prints of a scene that is to serve as a background, take them to the printer, and have him add the lettering by running them through his press. Trim all the prints to uniform size, say 2½" x 4", so the printer can handle them easily. Colored inks, plus toning of the prints, will add pep to your design. If you wish, you can use a colored stock.

Printer's type can be used in another way to produce a novel label. Set the form for the label in type, or have a printer do it, just as if it were to be used in a press. Ink a roller with white, bright yellow, or other light-colored ink, and run it over the type, coating the letters evenly. Then place the chase, with the type locked in place, in front of the copy camera. Illuminate it with a spotlight at a rather sharp angle. The shadows produced by the type lend interest. You can experiment with the lighting, and perhaps devise a set-up in which the letters will look better if inked in black rather than a light color. Make a negative on either process or ordinary film. Some people like a lot of contrast in such a la-

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Here's the Complete Table of Contents for the Second Installment in the September Issue

CHAPTER III
Various Darkroom Adaptations
Darkroom Equipment
How to Care for Equipment
How to Use Equipment Correctly
How Solutions Are Mixed
Nature of the Water Supply
Use of Distilled Water
Storing, Handling and Mixing Strong Acids, Poisonous Chemicals and Costly Ingredients
Making Percentage Solutions
Use of "q.s.", Aliquot Parts, Stock Solutions, etc.
How to Read Graduates
How to Use Scales and Balances
Effect of Absorbed Water on Some Chemicals
Loss of Chemical Value through Oxidation
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SEPTEMBER ISSUE
Popular Photography
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bel, others prefer less. Finally, mask the negative and print the labels by contact or projection. It is best to use rather large type.

From magazines, catalogs of printers' type, newspapers, and other printed matter, you can cut letters and words and combine them to form a label dummy. Paste the letters carefully on a sheet of white cardboard, block out unwanted lines with Chinese white, and make a copy on process film. If you combine a photograph with the design, a commercial ortho or similar film probably will be best.

Given considerable time, and daylight or an artificial source of ultraviolet, you can make distinctive labels by contact-printing your copy negative on blueprint paper. The familiar blue tone is in itself attractive. Or you can tone it brown by treating the print as follows: Immerse it in a weak solution of caustic soda until the blue turns to orange or yellow. Wash the print well, then place it in a solution of about ½ oz. tannic acid in 10 oz. water. When the print is the tone you want, wash it thoroughly, and dry.

Labels having a black or gray background should be used without white borders, because the mount itself is light in tone. Labels having a white background can be provided with borders composed of rather narrow, black lines. One way of forming these in printing is to place a rectangle of cardboard over the label before or after it has been exposed, and darken the projecting edges with a flashlight beam or other white light. Be careful to keep the mask and printed design properly aligned. The rectangular mask can have a deckled edge, if you wish, or you can make a scalloped edge by punching a row of evenly-spaced holes with a ticket punch, and cutting through their centers with a trimmer or shears.

Although labels usually are applied to the backs of mounts, sometimes they are used on the front of exhibition prints—usually near one of the lower corners. Such front-surface labels may contain such information as the maker's name, his club, the date, and the title of the picture.

An adhesive for the backs of labels, similar to that used on stamps, is made as follows:

Dissolve one-half teaspoonful of gum arabic in a little water. Add 2 teaspoonfuls of granulated sugar and one-half teaspoonful of laundry starch. Boil the mixture for 5 minutes, and then add a drop or two of vanilla or other flavoring, and enough water to produce an easy-spreading consistency. Apply this mucilage to the backs of the labels with a spreader made by wrapping a piece of flannel around a rectangular piece of cardboard or an old piece of film folded once. After the coating is dry, the labels can be stacked. Moisten the gummed surface when the label is to be applied.

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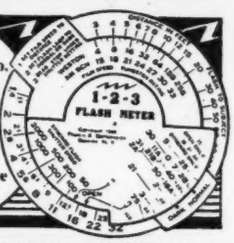

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Contests and Markets

POPULAR PHOTOGRAPHY, 608 S. Dearborn St., Chicago, Ill., announces its 1941 Picture Contest with over $6,000 in cash and valuable merchandise prizes. Good pictures are all that is required to compete—the contest is open to all photographers, amateur and professional alike. It is conducted in two sections, color and black-and-white. Closing date is Sept. 2. See page 55 for complete details and entry blank.

FOTOSHOP, INC., 18 East 42nd St., New York, N. Y., announces that it will award additional prizes to winners in the 1941 POPULAR PHOTOGRAPHY Picture Contest whose photographs are taken with materials purchased at Fotoshop. A Kodak Ektra camera is first prize for black-and-white, and a 2¼x3¼ National Photocolor Miniature Camera is first prize in color. Additional prizes will be awarded all winners who are Fotoshop patrons. For details, see the advertisement on page 11.

THE MUSEUM OF MODERN ART, 11 West 53rd St., New York, N. Y., announces an "Image of Freedom" contest open to any photographer in the United States upon payment of a $1.00 entry fee. Pictures are to express what America means to Americans. The best 100 entries will be purchased at $25.00 each. Closing date is Aug. 15.

DEJUR-AMSCO CORP., Shelton, Conn., announces a nation-wide photographic contest with over 50 merchandise prizes worth well above $1,000. All photographers are eligible. There are no limitations on subject matter. Closing date is Sept. 30. For details, see your photo dealer or write the Contest Director at the above address.

THE "VISIT ST. LOUIS" COMMITTEE, 511 Locust St., St. Louis, Mo., announces a $500 prize contest for the best pictures taken in St. Louis this summer. Everyone except residents of St. Louis and its suburbs is eligible. Closing date is Sept. 14. There will be general prizes and a $5.00 award for the best picture submitted by a resident of each of the 48 states.

THE LONG ISLAND ASSOCIATION, 273 Pennsylvania Station, New York City, announces a contest with over $500 in cash prizes for the best pictures taken in the four counties of Long Island and on their adjacent waters. There will be general prizes and awards in each of seven classifications. Closing date is Nov. 1.

THE NEW JERSEY COUNCIL, State House, Trenton, N. J., announces a summer photo contest for pictures taken anywhere in New Jersey or off the New Jersey coast. Over $100 is offered in cash prizes. Four awards will be made in each of four classifications. No entries will be returned. Closing date is Sept. 10.

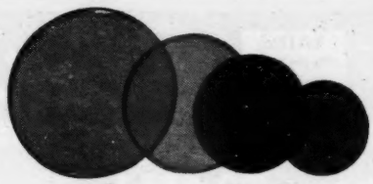
THE STATE OF KANSAS offers $100 in prizes for the best pictures taken in Kansas this summer by out-of-state residents. For a guide book of tourist attractions and historical spots, entry blanks, etc., write the Coronado Commission, Lyons, Kansas. Closing date is November 1.

RABSONS, 111 West 52nd St., New York, N. Y., announces a "Miss America 1941" color picture contest with $1,000 worth of prizes for the winning photographer and awards of the same value for the model. Contest details, release forms, entry blanks, etc., are available from the Contest Director at the address above. Closing date Sept. 15.

CHICAGO CINEMA CLUB, 20 N. Wacker, and ESQUIRE THEATER, 60 E. Oak St., Chicago, Ill., announce a $500 contest for amateur movie makers in the Chicago area. For details and entry blanks, write the Movie Contest Director at either of the above addresses. Closing date has been postponed to Sept. 15.

UNIVERSAL CAMERA CORP., 28-30 West 23rd Street, New York City, has extended the closing date of its $1,000.00 Mercury Photo Contest to July 31, 1941. The contest is open to all amateurs owning Mercury cameras. Rules and full information are available from Universal Camera Corp., at the above address and from Mercury dealers.

THE BERESFORD CAT CLUB OF AMERICA announces a contest for "a fine photograph of a fine cat." First prize is $10.00, second prize, $6.00, and third prize, $3.00. Closing date is Nov. 8. For details and entry blanks, write Mrs. A. A. Gour, 6638 Kimbark Ave., Chicago, Ill.



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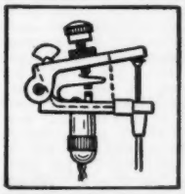

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Classified Advertising

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ALL Like New; 2 Years Guaranteed: Parvola ½VP., f 2, $42; Reflex Korelle II, f 2.9, $69; Leica "G," f 2, $115; Leica "G," f 1.9, $165; Contax II, f 2, $145; Contax II, f 1.5, $165; Contax III, f 2, $155; Contax III, f 1.5, $175; Contaflex, f 1.5, $185; Contaflex—Lenses: Sonnar 135 MM, $85; Sonnar 85 MM, $120; Cine-Kodak 8-60, f 1.9, $39; Bell & Howell Double-Eight, f 2.5, $42; Zeiss Turita 8x24, Featherweight, $69. American Camera Exchange, 2130 Broadway, New York.

ANNIVERSARY Speed Graphic 3¼x4¼, Kalart Rangefinder, 4.5 Zeiss Tessar, $95.00. Weston Master Meter, $18.50. Both like new. Marc Antony, 1510 St. Charles Ave., New Orleans, La.

ROBOT II, Biotar f 2, with accessories, like new, cost $270. Sacrifice for quick sale, $125. H. F. Berns, 1025 North 15 St., Manitowoc, Wis.

4x5" Graphic, f 6.3, $65.00. Center section Johnson Overhead Floodlight, $20.00. Ralston Boone, State Police, Charleston, W. Va.

105 NEW, used cameras. All makes. Movie equipment. 20 to 60% under regular price. Trade-ins. Describe details your desires. Brenner Company, 943 Penna. Avenue, Washington, D. C.

DETROLA Model K, f 3.5, 1/200 second shutter, Eveready case. Like new. Leonard Erxleben, Pekin, Ill.

3¼x4¼ Auto Graflex; B&L Tessar; extras; perfect; $75.00. Dr. George Fielding, Glens Falls, N. Y.

COOKE Telephoto Series VIII, 8½" f 5.6, new and in perfect condition. Best offer. E. Gowdy, Summit St., Fitchburg, Mass.

DOLLINA II, f 2, $55. Omega A, f 3.5, $45. 5x7 Graflex f 4.5 Tessar, Case, 4 holders, $75. James, 315 Fifth, Elyria, Ohio.

KORELLE REFLEX II, Tessar, 2.8, like new, extension tubes, case, $95.00. Or trade for miniature graphic. Jay's, Delray Beach, Fla.

ARGUS C3, case, accessories, $35. Argoflex, Case, $30. Federal No. 219 Enlarger, easel, $20. Karhuz, 1643 E. 33rd, Lorain, Ohio.

12" Schneider f 5.5 Graflex, telephoto lens, $70. Henry Lefebvre, Press Gazette, Green Bay, Wis.

FOR SALE: Compass Camera, perfect condition. F. McRae, 1111 Medical Arts Bldg., Atlanta, Ga.

LIKE new, Miniature Speed Graphic, 4.5 B&L, Compur, FPA, three film holders, $80. Marable, Box 151, Cheyenne, Wyo.

Following Brand New Equipment. 9x12 cm. Zeiss Maximars, $78.00; 5x7 Korona View Cameras $34.00; 9x12 cm. Kawee Cameras, 4.5 lenses, new style compur shutters, $39.50; 9x12 cm. BeeBee Cameras with 5¼" Zeiss Tessars, $65.00; 2¼x3¼ BeeBee Cameras with f 2.9 lenses, $67.50; Watson 35 mm. Cameras, f 2.9 lenses in prontor shutter, $19.50; Welti 35 mm. Cameras, f 2.9 lenses in compur shutters, $37.50; Vest Pocket chrome Exaktas, 3.5 lenses, $125.00—same with 2.8 Tessar, $145.00; $60.00 Luminax enlarger for negatives up to 2¼x2¼, $19.50. Used equipment —50 mm. f 1.5 Sonnar for Contax, as new, $69.50; 135 mm. Elmar for Leica, not coupled, $49.50; 4" f 2.8 Hugo-Meyer for Contax, as new, $75.00; Stereo attachment for Leica, as new, $29.50; Plaubel Makina 2¼x3¼, Anticomar f 2.5, with holders, adapter and case, $139.50; Miroflex 6½x9 cm. f 4.5 lens, as new, $69.50—or with f 2.7 Tessar, $99.50; 9x12 cm. Miroflex, f 2.7 Zeiss Tessar, fine condition, $139.50; 3¼x4¼ Series C Graflex, as new, f 2.5 Cooke, originally $260.00, offered $139.50; 4x5 R.B. Graflex, Series B, f 4.5 anastigmat lens, $75.00; Leitz Focomat enlarger, fine condition, $45.00; 16 mm. Bolex equipped with 1" f 1.5, 3" f 3.3, 15 mm. Goerz 2.7 wide angle, excellent condition, $275.00; 8 mm. Bolex equipped with ½" f 1.9, 1½" f 3.5 telephoto and wide angle lens, as new, $235.00; TOP ALLOWANCES: $39.00 allowance for your Model 50 on new Ampro at $98.00, on new Bell & Howell at $112.50 with 400 ft. reels. $60.00 allowance for your Model 70 on the new 400 ft. Bell & Howell at $112.50 and $49.75 for your Keystone R-8 on the new Ampro at $98.00. $28.50 for your Model 20 f 3.5 on new Perfex Magazine Loading Camera at $59.50. $139.00 allowance for your Bell & Howell 16 mm. Filmo-Master on any new Eastman or Bell & Howell sound machine. Full list price for your Eastman, Bell & Howell, Revere or Keystone 8mm. equipment on new 8 mm. Bolex. TRADE OFFER: Firearms, binoculars and medical microscopes accepted in trade on cameras, motion picture cameras, RCA or Philco radios. Most liberal traders in the country, established in 1914. Complete repair service on all makes shutters, cameras, motion picture cameras and projectors. All work guaranteed. NATIONAL CAMERA EXCHANGE, 11 So. Fifth St., Minneapolis, Minn.

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LEICA G, f 2, case, 90 MM. Elmar f 4, case. Bernard Smith, 218 W. 24th, Owensboro, Ky.

28 MM wide angle lens for Contax, $46.50. Universal finder, $32.50. Eastman No. 2 Slide Projector in case, $25.00. Karl Schultz, Box No. 485, Austin, Texas.

ROLLEICORD f 3.5, 5 filters, sunshade, Eveready case, tripod, Weston 620 meter, Omega Super B 3" lens, 2 negative carriers, reducing attachment, 3 14x16 ena. trays, Eastman safe light, printer, and other sundries. Make offer. Richard Schuetz, 6117 N. Knox Ave., Chicago.

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WE pay highest prices for cameras; accessories; movie equipment. Estimates free. Trade-ins. Brenner Photo Company, 943 Penna. Avenue, Washington, D. C.

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CASH for used Cameras, Lenses, Photographic Equipment, Optical goods. Highest prices. Elman's, 105-PH South Wells, Chicago.

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Non-commercial readers who wish to buy, sell, or exchange cameras or equipment are invited to take advantage of our new reduced rates in this section. 15 words for $1.50. Extra words 25c each. Payable in advance.

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MOVIE EQUIPMENT

COMPLETE Passion Play, $2.95. 8 mm. Artcraft, Hammond Bldg., Hammond, Ind.

MOVIE Equipment—classified Bargains Galore. 8-16 mm Home movies. No-Wat-Ka, 255 Main Ave., Passaic, N. J.

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PHOTO SUPPLIES

LARGE Illustrated camera catalog 10c. Trade guns, Binoculars, anything for Photographic Supplies. Warshal's, First-Madison-N, Seattle.

SWAP

SHOTGUNS. Target Pistols and Binoculars accepted in trade on everything photographic, including Leicas, Contaxes, Eastman and Bell & Howell motion picture equipment and Da-Lite Screens. Write for catalog. Convenient time payments may be arranged on anything new or used. National Camera Exchange, Established in 1914, 11 So. Fifth St., Minneapolis, Minn.

$150 LaSalle Extension Course in "Traffic Management" for good camera. J. S. Ree, Fergus Falls, Minn.

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WANTED: Photographers for assignments. Write for details, free market letter. Free-Lance Photographers Guild, 219 E. 44th St., Dept. R, New York City.

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HOLDING the small filters supplied with Varigam paper sometimes becomes quite an annoying task, particularly if the enlargement being made requires any dodging. This work can be simplified by attaching the filters to the enlarger lensboard. Place four small screw-type coat hangers in the enlarger lensboard as shown in the illustration. Then make a cardboard holder for the filters, as shown, and slide it into place, supported by the hangers. With this setup it is easy to switch from yellow to blue and still keep both hands free for the necessary dodging operations.—*Tracy Diers, Jamaica, L. I.*

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A POPULAR PHOTOGRAPHY DIVIDEND

McKay on the Darkroom

The PHOTOGRAPHIC NEGATIVE

by

HERBERT C. McKAY F.R.P.S.

PART I

CHAPTER I

THE FILM EMULSION

Origin of the Emulsion—The Modern Emulsion—Radiation Spectrum—Color Sensitivity of the Emulsion—Nature of the Emulsion—Emulsion Response to Light—Summary.

THERE has been a tendency during the past decade to mechanize the processes of photography; or, what is almost as bad, a tendency to assume that the exercise of manipulative skill is limited to making the print. Starting with an emulsion of known characteristics, the exposure meter indicates an unalterable exposure; a standard developing solution is used in fixed concentration, at fixed temperature, and for a fixed time. Whatever may result from these steps is the final negative from which prints of varying character may be obtained only through control of the printing process.

The net result of this attitude toward photography is simply to remove forever the possibility that photography may in time prove its claim to a place among the fine arts. No artist, regardless of his medium, handicaps himself with rules so fixed that his technique becomes invariable. In photography the production of the negative is the one step above all others which should be marked by the discriminating use of skill on the part of the operator.

It must be remembered that the artist of the flowing tie, long hair, and Bohemian mode of life is not the productive artist. Works of art are produced, as a rule, by hard-working men and women who have a deep love for their work but rarely more than an average conception of their own individual worth. These artists have achieved a mastery of the technical and mechanical phases of their work, and understand the physical limitations of their media. The etcher knows his paper, his inks, his acids; the painter knows which pigments are stable and which are not, which are transparent and which are opaque. He knows when to use canvas and when to use board. These things, like the scales of the musician, are not particularly interesting, but they are vital to the production of the desired result.

The photographer can quite easily—and in fact often does—exercise his skill in composition and lighting. He works sincerely to obtain his picture, and then submits his carefully exposed film to the standardized processing of the commercial finisher. Strangely

enough he cannot understand why his picture does not correspond to his original conception. I have no quarrel with the commercial finisher. He has a job to do, and on the whole he does it well. He cannot, under the prevailing scale of prices, give individual attention to each negative; nor has he a mental image of an original subject which would enable him to produce the desired result.

Just what results can be obtained through manipulative development which would be lost under standardized conditions? The question is difficult to answer directly, because the differences are subtle. Perhaps the point is best made by reminding you that among all graphic arts photography has one point in which it is superlative—just one characteristic which makes it superior to other graphic media. Photography has the power to reproduce graduated tones of such delicacy that they exceed the limits of unaided human perception! So far nothing else which has the power to reproduce infinitesimal changes of tone has been developed by man! Two negatives may appear identical to superficial observation. One will produce a print of soft, flowing tone, yet the other, regardless of printing manipulation, produces prints of a harshness which cannot be eliminated even by reducing print contrast to the muddy stage.

Often an amateur will remark, "I wish I could make a print like that!" He could if he would realize the fact that **prints of rich quality are made from good negatives.** You won't find a printing demonstrator making prints from amateur negatives. To tell the sad truth he often uses orthochromatic plates—yes, glass plates—and develops them by visual inspection. The old timers had a trick or two. They had to because their materials were far from the high quality which is the rule today. The mere fact that among expert photographers of forty years ago the standard of print quality was, at least from a photo-technical point of view, superior to that of today should indicate that too much dependence upon fixed rules is not good.

The possibilities of manipulation in development might well be explained by an exaggerated example. Using roll film, make a copy of a printed page, and on the same roll photograph a number of cloth samples with the purpose of reproducing texture. Try to obtain good negatives of both exposures without cutting the film and using two developers. This is just the point involved in using a single emulsion, a single developer, fixed time, and fixed temperature!

In this text we will give our attention to the art (using that abused word in its true meaning) of negative making, rather than to the science. Naturally, science must do its part and receive due notice. However, formulas are obtainable by the quire from manufacturers, as are booklets and instruction folders. Much of this material is very good, but none imparts the broad experience and knowledge which the photographer gains for himself after a time.

Experience itself is of great importance, but along with that experience there is an intangible which is more important that any choice of developer or emulsion—namely, a definite mental attitude, an approach to the subject which can make it easy or difficult for you to acquire the desired mastery of the negative. This attitude can be suggested, and many hints given, which will make your progress easier. These things I shall try to do in the following chapters, to the end that you will derive from photography the deep pleasure of creative activity—that of making really good photographs, and of bringing into actual existence a picture which you have conceived and executed, and which, therefore, is essentially a part of you.

I would like to repeat a statement made to me recently by a man who perhaps has hung more prints in the great salons of the world than any other individual. "McKay" he said, "You're a technician and like to do a lot of experimenting. I'm a picture maker. For the last twenty years I've used nothing but Verichrome film and no developer but amidol, which I mix with a teaspoon and a kitchen tumbler!"

This man is an amateur; his name would be familiar to you were I to mention it. Our brave engineers may sneer and smile, but the fact remains that this man produces photographs which are definitely better than any I have seen. If some of our commercial photographers could but follow his lead their reputations would soar. I do not recommend his method as standard procedure. It takes years of experience, experience founded in the slow plate-visual inspection days, to follow such a lead successfully. But it does show that development is something decidedly more individual than merely putting a film to soak in the "soup" until the alarm clock rings!

Origin of the Emulsion.

It is quite obvious that if the negative is to be the subject of discussion, something must be known about the fundamentals of negative production. The logical starting point is the emulsion itself. But this emulsion did not spring, full grown, from the convolutions of a great brain. In fact there was a time when the emulsion was openly sneered at. To go back even farther, there was a time when there was no emulsion.

If we were to go back to the cradle of photography we should have several centuries to cover. Daguerre? Well Daguerre's process was hardly photography except in the sense that blue-printing, gravure, and similar processes are photography. Moreover, there is little doubt that posterity will yield to Niepce full credit for the process known as the Daguerreotype, and to that facile salesman Daguerre the credit which is his due, namely that of ballyhooing Niepce's process sufficiently to make it internationally known. To those who would take up arms I should suggest an impartial reading of the contemporary account as written by Root[1] and which contains the sad truth in letters written by and to contemporary scientists.

But in any event we are not concerned with Daguerre's short-lived process, as it was simply a negative image on metal. Rather let us consider Wedgewood and Davy, who made photomicrographic negatives around the turn of the century (1800-1801). Let us also consider Fox Talbot, whose original true photographs made before Daguerre's official date of 1839 are still in existence. These were real photographs, positive prints made from negatives. But no emulsion was used. The original negatives were made upon paper. Later, when photography became somewhat common, glass plates were coated with albumen or collodion, as the case might be, and sensitized by immersion in a solution of silver. The process was tricky because the plate had to be removed from the solution, placed in a plateholder, and exposed immediately. Should the plate become dry, even in a corner, the plate was ruined. There were other complications in those days. Projection paper was unknown; it was necessary, therefore, to use glass plates of the full print size.

You will wonder what equipment was necessary. We know quite well because there were amateur jour-

[1] "The Camera and the Pencil of the Heliographic Art," by M. A. Root (1864).

nals then just as there are today. One amateur of about 1865 was quite jubilant because he had worked out an outfit which could be carried by a strong man, or at worst "a man and a small boy," thus doing away with the necessity of using a pushcart or "perambulator" for the transport of equipment. Yes, "dark tents" of black cloth were actually set up at the site of the exposure as a part of the routine of picture making. The same issue carries a notice of the new dry plates, but it was said that the quality was unsatisfactory and that because of their extremely slow speed it was probable that these plates would never come into general use. And in those days slow meant S-L-O-W!

But it was really the emulsion which ushered in the modern age of photography, and this is the factor to which we must devote some attention.

The Modern Emulsion.

Before the emulsion, the sensitive surface was simply a solution of silver salts spread over a medium which served to hold it. The emulsion, on the contrary was a complex mixture—tiny grains of silver bromide formed in the gelatin matrix—and the whole mixture inherently sensitive from the moment it was made. It is often said that gelatin was used because it was the only vehicle of its kind known in the early days, but it must be remembered that both albumen and collodion were used before the invention of the emulsion-coated plate. Many vehicles were tried, including isinglass and both animal and vegetable glues. It was found that gelatin was suitable, not only because of its characteristic reaction with water, but a gelatin emulsion was decidedly more sensitive that those made with other supporting media.

In the first place, raw silver bromide made in direct solution and then submitted to a developer will reduced no matter whether or not it has been exposed to light. The gelatin therefore acts as a restrainer, the action doubtless being a physical one in a measure. However, the increased sensitivity of the gelatin emulsion over others has been found to be due to the natural presence in gelatin of a substance called gelatin-X. According to Neblette[2], this is analogous to allyl mustard oil, and is an allyl isothiocyanate ($C_3H_5.NCS$). Its presence in gelatin in concentrations of one to four parts per million is sufficient to impart the increased sensitivity recognized in gelatin emulsions.

Even when it was found that the basic gelatino-bromide emulsion was more sensitive that other colloido-bromide emulsions, the emulsion was far from being perfect. In fact it was but little better than useless; the degree to which it has been perfected is one of the modern miracles of scientific industry. The original emulsion, and indeed the basic emulsion of today, is a suspension of silver bromide in gelatin. There are relatively small amounts of other ingredients, including silver iodide, but the silver bromide is the major constituent.

In considering the reactions of silver salts we must avoid the common error of thinking of the photographic reaction as a reaction to "light," for we must, to be consistent, restrict the term "light" to visual luminosity. It is a grave error to speak of invisible light, or black light, or ultraviolet light or infrared light. These are not varieties of light but of **radiation.** Such a distinction might be hair-splitting if the subject of discussion were radiation itself, but when discussing photography the distinction is of paramount importance.

To make this perfectly plain, suppose we make use of a simple illustration. If a sheet of paper is stretched tightly over a frame we might stick a finger through it, shoot an arrow through it, or shoot a bullet through it. All three would make holes, but that would not mean that fingers, arrows, and bullets are identical. Moreover, we should not be justified in speaking of the

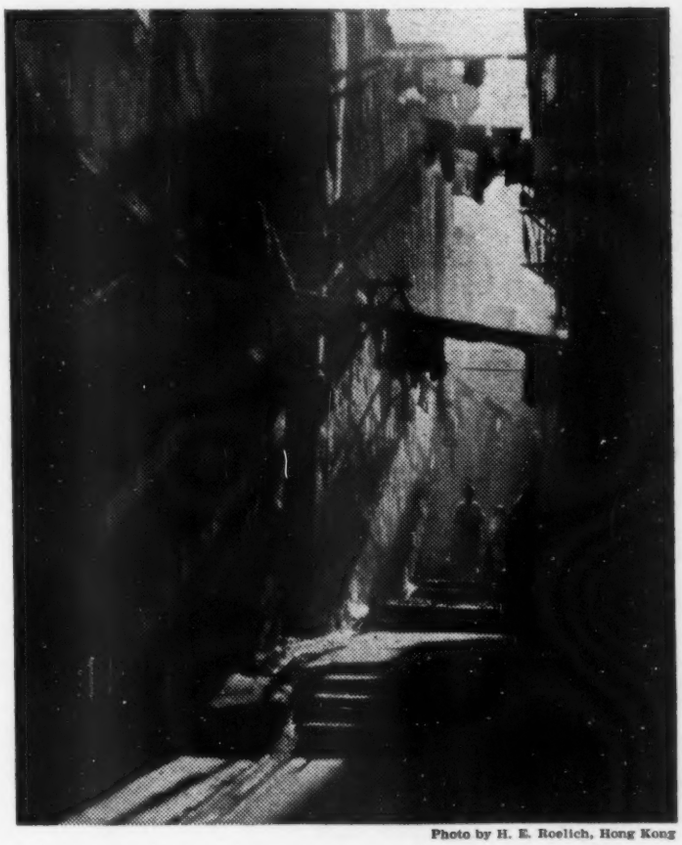


Photo by H. E. Roelich, Hong Kong

Photography is able to reproduce delicate changes of tone.

hole in the paper as either a finger, an arrow, or a bullet. The hole is simply the effect of the passage of one or the other of the three objects. In the same way, "light," analogous to the hole, is not anything of itself; it is simply the effect of radiation falling upon the eye. Therefore, while the emulsion is definitely affected by radiation it is not, speaking accurately, affected by "light."

Why is this important? Because most materials in nature respond definitely to radiation. X-rays and ultraviolet will cause some substances to **fluoresce;** infrared causes objects to become warm; radio stimulates the production of sound by radio loudspeakers, and so on. The illustration could be carried farther to show that no matter what the specific radiation, something reacts to it. Silver bromide exists under considerable strain, and radiation of a specific type will produce an incipient breakdown of the compound which can be carried through to completion by the action of definite chemicals.

It so happens that the specific radiation which affects the emulsion in this way overlaps the specific radiation which produces the sensation of light in our eyes. The photographic reaction is naturally a reaction of the ultraviolet, and the fact that the specific causative radiation includes a slight amount of the high visible blue-violet was solely responsible for the discovery of photography years ago instead of recently. Thus the original emulsion, like the non-emulsified

[2] "Photography, Principles and Practice," by C. B. Neblette, F.R.P.S.

sensitive coatings, was sensitive only to blue-violet, and the plates could be safely processed in the orange-yellow light which is now sometimes used for bromide paper manipulation.

Radiation Spectrum.

Before going ahead with a discussion of the controlled alteration of the emulsion reaction, the relation of photography to the **great spectrum of radiation** should be made plain. It would be impossible to present a graphic representation of the great spectrum in linear form, because at one extremity we have radio waves whose length may exceed ten miles, while at the other we have cosmic rays so minute that their actual wavelength is a matter of argument among scientists. The radiation which produces light lies midway between the two, and an average wavelength of visual radiation is 1/50,000 inch.

By devising a scale in which each division represents **ten times** the preceding one, the great spectrum can be presented plainly (Fig. 1). It must simply be remembered that while the ordinary scale of five steps would represent values of 1, 2, 3, 4, 5; the same five steps in this scale would have values of 1, 10, 100, 1,000 and 10,000. On this scale the zero point is 1 centimeter (about 2/5 of an inch). Each division above zero is ten times as great as the preceding one. Thus, the ascending scale is 1 centimeter, 1 decimeter, 1 meter, 10 meters, 100 meters, etc. The descending scale is the same, except that each division below zero is one-tenth that of the preceding. Thus the descending scale is 1 centimeter, 1 millimeter, 1/10 mm, 1/100 mm, 1/1000 mm (1 micron), 1/10 micron, 1/100 micron, 1 millimicron, 1 Angstrom, and so forth. On the left of the scale are shown the principal bands of radiation, except in the case of the range of visible light, which is noted on the right to prevent crowding the ultraviolet and infrared. Ultraviolet ranges upward, merging with X-rays, while infrared ranges from 10^{-4} to about 10^{-3} where it merges with Hertzian radiation.

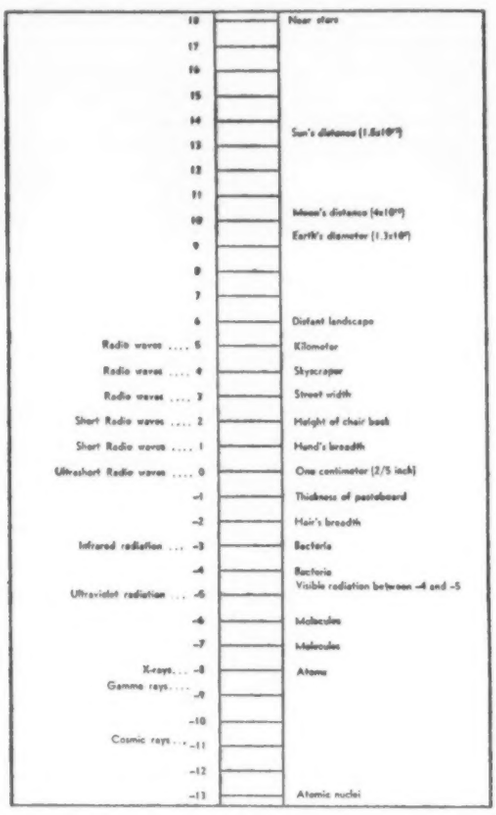


Fig. 1. The Great Spectrum. Notations, right, give a graphic idea of actual wavelength size.

Everyone has seen a rainbow, and many have witnessed the spectrum formed by a glass prism (Fig. 2).

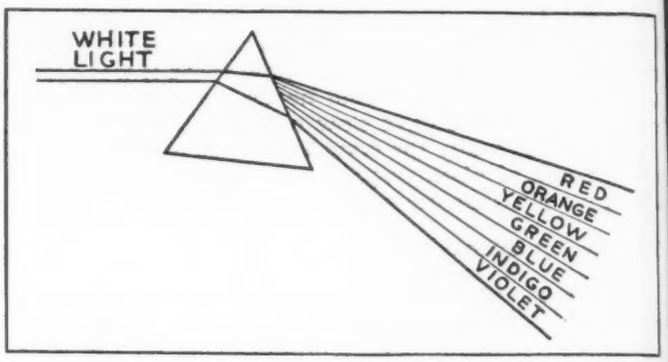


Fig. 2. White light dispersed into its spectral hues by a prism.

And everyone is familiar with the seven colors into which white light is divided—red, orange, yellow, green, blue, indigo, and violet. Considered photographically, however, the spectrum is divided into three major divisions—blue-violet, green, and red-orange (referred to simply as blue, green, and red). The position of visible light is shown in Fig. 1 simply as a division line of the great spectrum, but as we shall be concerned with it, a separate illustration (Fig. 3) shows it in detail. The visible spectrum, more commonly known as the "rainbow band," is the colored band which is seen when white light is separated into its component parts. It will be noticed (Fig. 3) that the visual spectrum has been extended into the adjacent ultraviolet and infrared bands. As both these are photographically active when modern emulsions are used, they will be discussed with the visual spectrum.

It must be understood that all radiation, no matter what its position in the great spectrum, is identical except for two interdependent characteristics, **wavelength and frequency.** Inasmuch as the velocity is constant, some 186,000 miles per second, it is obvious that when wavelength is shortened, frequency must be increased. So radio waves, heat, visible light, ultraviolet, X-rays, cosmic rays, and all radiation forms are merely effects produced by the same radiation in different wavelengths and frequencies; and it is quite probable that the frequency is the important factor with wavelength an incidental accompaniment. Radiation may or may not be perceived by our physical senses. We recognize infrared by its heat and ultraviolet because it produces sunburn, but only in the visible spectrum do we find any radiation to which we respond specifically.

Following radiation up the scale of frequency, we know that if an iron rod is heated we can feel the heat radiated from it. If it gets hotter it begins to glow with a dull red color. That marks the division between infrared and visible light. The hotter the iron gets the faster become the frequencies of radiation it gives off. It grows orange, then yellow, then blue-white, and if heated by the passage of an electric current it next begins to radiate an abundance of ultraviolet.

So we see that the rainbow colors are simply indices of radiation frequency. Nor are the limits of visibility at all fixed, for some persons can see deep

red or pale violet where others see only blackness, indicating a variation of visual limits among different individuals. Just so with the photographic emulsion.

Because the frequencies are given in such large numbers, the corresponding wavelength is used for measurement. There are two different units used in

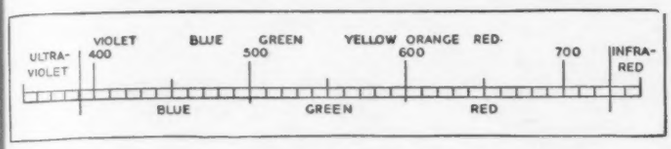


Fig. 3. The visible spectrum, showing three major divisions.

measuring visible light, the millimicron and the Angstrom. As there are ten Angstroms to the millimicron, the difference in measurement is merely that of adding or dropping a zero from the figure. To make the point more graphic, it may be well to add that in round numbers it would require two hundred and fifty million Angstroms to equal one inch. The limits of visual light are usually given as 380 and 750 millimicrons (3800 and 7500 Angstroms), and these limits are close enough for all practical purposes.

The photographic emulsion in which we are interested has but a single function, that of breaking down to liberate bromine and deposit a grain of opaque metallic silver where there was a translucent grain of silver bromide. This breakdown may be produced by one of several agencies. Various chemical fumes including household gas will do it, excessive warm dampness will do it, simple physical pressure will result in a mark, but all of these we wish to avoid. The breakdown which we want is that provided when specific radiation falls upon the sensitive surface. We want to limit the reaction to specific radiation, and to exclude the action of such radiation as X-rays and ultraviolet, both of which affect the emulsion readily. X-rays are not a serious source of danger, as most of us live and work far enough from X-ray generators to be safe. Fortunately, although the emulsion is highly sensitive to ultraviolet, the materials of which our cameras are made exclude these rays, while the glass used in the lenses permit only an insignificant amount of ultraviolet to pass.

Later we shall discuss the controlled use of X-ray, ultraviolet, and infrared radiations, but just now we have limited the field to that of visible light.

Color-Sensitivity of the Emulsion.

As the emulsion is most sensitive to ultraviolet, it is natural to assume that the visible light which will affect the emulsion most strongly is the high violet adjacent to the ultraviolet. This is true. So we have in the emulsion, a chemical compound which is sufficiently unstable to break down under the impact of any one of several groups of radiation, the most important of which is that high violet region immediately adjacent to the ultraviolet.

This is a far different emulsion than the one which we use in our cameras today, but the difference lies, not in basic composition, but in the use of accessory ingredients which act upon the light in such a way that the longer wavelengths of green, yellow, orange, and red will also produce the desired incipient breakdown. These accessories are dyes which are mixed with the emulsion.

For us, the principal interest lies in the fact that through the use of dyes, the emulsion may be made to respond to colors to which it ordinarily would be inert or "blind." The accompanying curves (Fig. 4) show the relation between visibility of the average human eye and the sensitivities of five types of emulsions. The untreated emulsion, known as **color-blind** and typified by positive emulsions, lantern plates, process films, and so forth, is generally sensitive only to the blue and violet. This means that the photograph will show blue and violet as white and others colors as dark gray or black. It must be remembered when such statements are made that pure colors found in full white light are meant. In actuality, shadows revealing modeling will be reproduced, but even then the general fact holds true.

An emulsion which has been treated with dyes to extend its sensitivity to include green is known as **orthochromatic,** a misnomer remaining from the days when the increase in color response was considered so wonderful that the name "right color" was bestowed

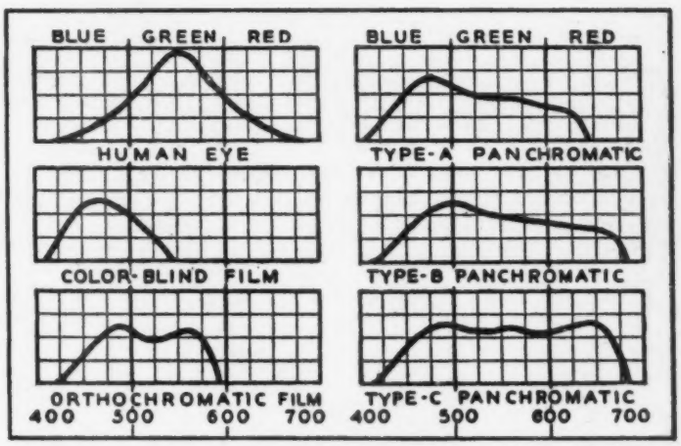


Fig. 4. Series of spectrograms showing the color sensitivity of five types of emulsions compared to that of the human eye.

upon the emulsion regardless of its blindness to red. When the emulsion is so treated that it responds to all visible colors, it is known as **panchromatic,** meaning "all colors," a name probably better suited than the already usurped "orthochromatic." The emulsion to which that name should be given—that is, one which reacts to all colors, and to a degree similar to that of visual sensitivity—is known as the **orthopanchromatic** emulsion.

It must be borne in mind that the term "panchromatic" simply indicates that the emulsion is sensitive to red as well as to the other colors. This is just like saying that a man is a soldier without indicating his rank. The panchromatic emulsions vary widely both in the matter of speed and in their specific color reactions. There has been some attempt to divide these emulsions into three types called **A, B,** and **C.** This subclassification is better than none, but it must be remembered that among the various brands of emulsions and among the various special emulsions, such a grouping must indicate arbitrary boundary lines which are characterized more by being overlapped than by any sharp distinction. Many emulsions are midway—perhaps more than adhere to the true classification.

A more accurate indication of the nature of these three classes is found in the names **panchromatic (A), orthopanchromatic (B),** and **hyperpanchromatic (C).** The type A is the direct descendant of the original panchromatic emulsion, somewhat sensitive to red but far more sensitive to blue. It requires a filter to produce

a result even resembling the panchromatic result.

Orthopanchromatic (or type B) has an almost uniform sensitivity to all colors, and having a comparatively high green sensitivity it most closely approaches the reaction of the average human eye. It does not require the use of a filter, but naturally reacts well when a filter is used. It is the most nearly perfect emulsion we have in point of color response.

Type C is the high-red-sensitive panchromatic made for one purpose, to give the utmost possible speed with incandescent light. It requires a green filter for normal reproduction because it combines the normal high blue sensitivity with an abnormally high red sensitivity, and for ortho results both red and blue must be suppressed to some extent. When the green filter (which is classed with the "yellow" group) is too heavy, the best procedure is to use a sky blue one to retard the red. Emulsions may fall anywhere within the range of all three, but any panchromatic film which has an unusually high sensitivity for incandescent light may be regarded as of type C, while most normal pan films of today can be correctly placed in type B.

Coated plates and films which are naturally color-blind can be sensitized to color by the use of dyes. Solutions of Pinaflavol and Sensitol red may be made —about four parts dye to a million parts of water. The films are soaked in cold water until the emulsion is thoroughly wetted, and then bathed in the two dye solutions, successively, or in a mixture, for about two hours at about 50° F. The process is not recommended as routine, but as an experiment it will prove interesting. The use of dyes to extend the accidental overlap of the two regions of photo and visual sensitivity in the blue has made it possible to use the photographic process to reproduce material objects with a fair approach to monochromatic accuracy in color value. Naturally without such extension, natural color photography would not be possible at all.

It must be kept in mind at all times that the names given are only approximate. Color-blind films may be used to reproduce yellows, and many orthochromatic emulsions will give quite satisfactory results when used with a light red filter. The names given indicate the **relative** sensitivities, and an exposure which would satisfactorily record other colors on an orthochromatic emulsion would still leave red objects extremely dark.

The subject of color sensitivity has purposely been introduced before a discussion of the inherent characteristics of the emulsion simply to clarify the issue. The basic emulsion is largely the same, no matter what its sensitization, and that is the emulsion which we shall now investigate.

Nature of the Emulsion.

As is generally stated, the photographic emulsion consists of a mixture of gelatin and silver bromide coated upon a suitable base such as glass, celluloid, or paper. There are many varieties of emulsions, but a typical emulsion has these chief ingredients in approximately the percentages shown:

Water	10
Gelatin	55
Silver bromide	33
Silver iodide	2
Silver chloride	trace

Silver bromide is found in the emulsion in flat crystals of triangular or hexagonal shape with a thickness about 1/10 their diameter, although this proportion varies widely. The size of the crystals usually varies from 0.0002 to 0.004 millimeters, depending upon the character of the emulsion. It must be remembered that in any given emulsion there is a wide variation in grain size, and these measurements are only the average. In a typical high-speed emulsion, the majority of grains are of the larger dimension, with approximately a half billion grains per square centimeter.

The emulsion itself is thin, the average ranging from 0.025 to 0.04 millimeter in thickness. Although this means that six or seven hundred emulsions could be piled up and not equal an inch of thickness, the emulsion must never be regarded as a mere surface. It is a layer of finite depth upon the surface of the support, a layer built up of many strata. It can be seen that with grains of the largest size, that is 0.004 mm, the emulsion is thick enough for ten such grains to lie edgewise in the thickness of the emulsion. As a matter of fact, considering the accidental orientation of the grains and their varying size, it will be convenient for purposes of description to consider the emulsion as having twenty such definite strata (Fig. 5), although **in the actual emulsion there is no stratified structure.**

Flowers photographed on color-blind film.

Same shot made on an orthochromatic film.

Another shot taken on panchromatic film.

The most accurate magnified picture of the emulsion which comes to mind is a flat pie pan filled with gelatin dessert into which is mixed a quantity of chopped nuts. This presents a picture true in every respect of the developed emulsion, because in the process of development the definitely-shaped grains gather into irregular clumps of various size, not at all dissimilar to broken nut meats.

The next question is, "What happens when the emulsion is exposed to light?" It has not as yet been definitely answered. Many theories have been proposed; some facts are known, and from the mixture of fact and theory we have a fair picture of what may be the truth. The silver bromide grain has a definite lattice structure, as have all crystals. This lattice is formed of atoms of silver and of bromine; but the combination is rather unstable. That is, it takes very little stimulus to cause the silver and the bromine to part company. Nor is it necessary for a complete grain to break down. Some of the silver atoms may combine and form a sub-microscopic speck of silver within the grain. This actually does happen, but there is some division of opinion as to whether these specks are present **before** exposure or whether they have their origin **during** exposure. There is also some question as to whether the specks are metallic silver or silver sulfide, although the general opinion seems to favor the metallic silver theory.

Thus we have a silver-bromine compound so unstable that it may be partially dissociated without a complete separation taking place. This compound is exposed to the impact of light. Again we have various theories, but the favored one is that of a physical impact of the light unit or **photon** upon the emulsion, just like a bullet being fired into a shelf of fragile pottery vases. This physical impact either produces the initial silver speck, or using that as a focus, produces a similar and greater breaking down of the compound. We now have a condition in which many of our vases are cracked by impact but still hold their shape until touched, when they crumble. Just so we have the silver-bromine compound still holding its general form, but ready at the touch of a reducer (developing solution) to break down into its component elements.

There is a definite relationship between the amount of light per unit area necessary to produce this crack-up, usually stated as so many units of energy per square micron grain area. This is not a fixed factor by any means, as some grains are more stable than others. This is important because, except for the formation of the sub-microscopic sensitive speck, it is not possible to break down a portion of the grain. Once the disintegration has started the entire grain gives up its bromine and becomes silver. This action is also imparted to any other unexposed (or exposed) grain which is actually in physical contact with the grain which breaks down.

It is obvious that with a half billion grains in an area considerably smaller than a dime, many grains will touch and some of them even form long, crooked chains. This does happen, and it is the breakdown of these connected grains which is responsible for graininess, loss of resolving power, and other faults of the negative characterized by the absence of a knife-sharp border around any area. Therefore, just as it is the intention of the emulsion maker to have each individual grain coated with a protective layer of gelatin, it is our intention in processing to make use of a developer which shall develop every grain which has been exposed to light, but one which shall not destroy the delicate insulating wall of gelatin and cause the reduction of grains which have not been exposed. We shall see that this ideal cannot be fully attained in either respect, but we can approach it nearly enough to enable us to obtain good quality in the resulting negatives.

Naturally the question arises as to how this emulsion is formed. At the risk of some repetition, now that we have a general picture of the basic emulsion in mind, we shall see just how the emulsion is made.

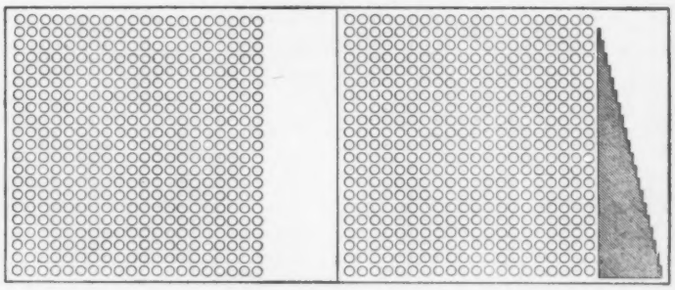


Fig. 5. Representing 21 strata in an emulsion, each with 20 equal units of silver bromide.

Fig. 6. Light-absorbing wedge is placed over this emulsion to regulate exposure (see text).

The ingredients include pure silver nitrate, potassium bromide, potassium iodide, and gelatin. The bromide and iodide are thoroughly mixed into the gelatin, the salts being in solution at the time. To this solution, which is kept warm and continuously agitated, the silver nitrate solution is added slowly. The nitrate solution may be neutral but is usually slightly alkaline, ammonia being used to obtain the desired alkalinity. The rate of mixing and relative amounts affect the final result. In fact, perhaps more than any widely used commercial product, the emulsion varies according to the treatment it receives in manufacture. For example, if the metallic salt solutions are added slowly and in the form of weak solutions, the resulting emulsion will tend toward finegrain results and low sensitivity characteristics, while if concentrated solutions are added rapidly the result tends to be coarser grained and faster.

After the mixing, the emulsion is ripened by cooking it at a low temperature for several hours. The temperature during this step is controlled accurately, and is usually in the neighborhood of 140° F. This process makes the emulsion more sensitive, but if allowed to continue produces grains which will develop without the usual exposure to light. In short, this produces chemical fog, of which a trace at least is expected in all normal negatives. When the cooking step is complete, a solution of heavy gelatin is added to make the whole emulsion set more readily.

When the gelatin has set into a firm jelly, it is forced through a press which is not unlike a food chopper, but instead of a revolving blade, the end of the press is a perforated sheet through which the gelatin is forced, taking on the form of long shreds, not unlike spaghetti. These shreds are washed thoroughly in repeated changes of water to remove the soluble salts remaining in the emulsion—the bromide, nitrates, and ammonia if any was used. After washing, the shredded emulsion is kept in cold storage until wanted for use.

When coating is to be done, the shredded emulsion is removed from its ice storage and drained to remove any collected moisture. It is then melted over a water bath (as dessert gelatin is cooked in a double boiler), and at this stage various additions are made. Usually alum is added so that the emulsion will become com-

paratively hard when dry and therefore withstand handling. At this stage a small part of potassium bromide also is added for exactly the same purpose it is used in the developer, namely, to hold back chemical fog and to produce a better negative. At this stage are added the sensitizing dyes, and finally a wetting agent of some kind which will cause the mixture to flow over the surface of the support more readily and more uniformly.

The base is first given a coating of insensitive material with which the emulsion can bond and so cling firmly to the support. The first rollfilm was not made simply by coating a piece of celluloid with emulsion. That was tried years before the film became a success. The real invention of the rollfilm was made when the use of the substratum was invented.

The melted emulsion is flowed over the base and then set, usually by the use of some type of refrigeration. It is then further dried and finally cut into the required size and packed for use. This, then, is the nature and method of manufacture of the sensitive materials which we shall use for making the negative. Thus far we have dealt with an imaginary thing which we have called an "average" emulsion. In fact there are many, many different kinds of emulsions, but those which we shall use in producing negatives resemble our "average" closely enough for us to continue to use this dummy emulsion for purposes of demonstration.

Response of Emulsion to Light.

Assuming an emulsion is to be exposed to light, what happens? To explain this we shall have to consider the problem from different points of view. First let us assume that the emulsion (coated upon a smooth support) is simply exposed to light for an undetermined period. The bombardment of light affects the grains of silver bromide as has already been explained, making them unstable. But this action is not instantaneous. Just as we must consider lengths measured in millionths of an inch as finite measurements of length, we must also consider microseconds as finite measurements of time.

The bombardment first strikes those grains near the surface and then, progressively, the grains which lie at lower and lower depths, until the entire emulsion has been penetrated. Thereafter the light will pass on until it strikes the supporting surface behind the film and again it will pass through the emulsion, this time starting at the bottom layer and working upward until it passes out again on the same side it entered. If this emulsion is then submitted to the action of the developing solution, almost all of the grains of silver bromide will be transformed into microscopic grains of metallic silver, and the thin tissue of emulsion will become practically opaque to light.

Notice that **almost all** of the grains will be altered. In fact there are some grains which are affected by light only with difficulty, and still others which are so refractory that many times the light required to bombard the greater part of the mass completely will fail to alter them. Thus we have a certain residue which has no practical value. However, these grains are so few that they do not seriously affect the final result.

If it is true that the light passes through the emulsion progressively, it should be possible to regulate the exposure so that the light can be stopped when it has only half penetrated the emulsion, or to limit it to any other portion of the whole which may be desired. This can be done. In fact it is exactly this control which makes possible the photographic process. In considering the regulation of light we will ignore the factors of light intensity and time of action for the moment, and concern ourselves with the product of these two factors—namely, the quantity or volume of light. It is true that we regulate the volume through dual controls of time and intensity, but as these have a variable relation we shall consider imaginary "units" of light of constant volume-per-unit.

As we have taken a twenty-strata emulsion for purposes of discussion (Fig. 5), we shall also assume twenty units of light to be available. We shall also assume that one unit of light has just sufficient volume

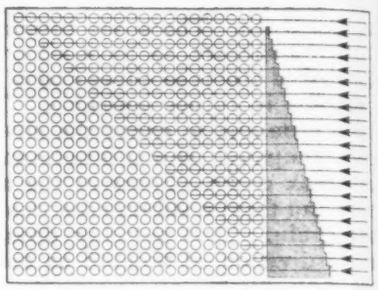


Fig. 7. The emulsion is exposed to light of 20 units strength. Lines from arrows represent amount of penetration.

to react with the topmost layer of sensitive grains. Having twenty units of light available, we shall also assume that we have a translucent tablet (similar to a negative) with twenty strips of varying density (Fig. 6). The first strip will absorb all twenty units of light; in other words it is opaque. The second will absorb nineteen units, the next eighteen and so on until the last one absorbs just one unit of light. This tablet is placed over the sensitive emulsion so that a narrow band of the emulsion is exposed to the action of light which passes the end of the tablet and is therefore full strength. This gives us twenty-one different exposures on the emulsion.

Where all of the light is absorbed, there will be no action upon the negative. In the next strip where there is a loss of nineteen units, one unit will pass through and its energy be expended in reacting with the topmost layer of grains, and so on. Thus, throughout the emulsion we have the light penetrating deeper and deeper (Fig. 7), until the entire thickness of the emulsion is affected.

This is indicative of what actually happens when the emulsion is exposed in a camera. In fact there are many times in laboratory and experimental work when the emulsion is actually exposed under such a tablet—for example, when sensitivity measurements are being made with the Eder-Hecht densitometric tablet. This tablet is a small film—a test negative, in fact—containing narrow bands of increasing density so that one end of the film is transparent while the other is practically opaque. At the sides of this tablet there are two sets of three bands which cross the others at right angles. These sets are covered with tri-color filters so that a single exposure will give not only a numerical evaluation of the sensitivity of the emulsion under test, but it will also give a similar evaluation of the sensitivity of the film to each of the three principal spectral bands. Inasmuch as these three bands, (the blue-violet, green, and red-orange) correspond to the limit sensitivity of the three major types of emulsion, the Eder-Hecht tablet provides information about three important factors: the overall sensitivity of the emulsion; its color-response type, whether color-blind, orthochromatic or panchromatic; and the relative sensitivity to the spectral bands.

Such a tablet is an efficient sensitometer, and for the usual run of amateur work it will satisfactorily re-

place the far more costly disk sensitometer. Although not now available in the original form, it is said that an improved tablet of domestic make will soon be available.

It must be remembered that when the light falls upon the emulsion the change which takes place is not visible. True, if the action continues through long exposure to light there will gradually take place a complete breakdown, and the emulsion slowly darkens; but we are not concerned with this at the present time. The brief exposure we have given the emulsion (Fig. 7) only serves to produce the incipient breakdown we have already described, but there are two characteristics of this preliminary reaction which we must keep in mind.

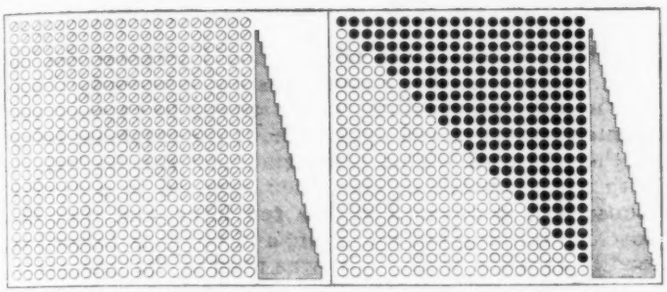


Fig. 8. Exposed silver halide units, ready to be developed, form invisible latent image.

Fig. 9. Units of latent image converted into metallic silver by the process of development.

Although invisible, the emulsion has reacted proportionately according to the intensities of the original exposure (Fig. 8), and there is a physical image in the emulsion, even though it is not visible. This is the latent image. The second point is that after exposure, the "innoculation," if we may be permitted the term, does not spread, but remains confined to the original image. There is one change which takes place, namely, the further breakdown of the sensitive material, so that for a short time after exposure there is a growth in intensity of the image analogous to an increase in the original exposure. This is sometimes spoken of as a gain in sensitivity after exposure; but it seems improbable that there would be a gain in sensitivity after the stimulus to which the emulsion is sensitive has passed.

This after-growth is variable and is dependent upon atmospheric conditions. There are some places, particularly the deep tropics, where the latent image fades, and it has been reliably reported that films exposed and left undeveloped for three or four days may be used again without the slightest trace of the first image being apparent in the negative. Development is advised within two hours after exposure, and even when a decided overexposure is made. I have had no personal experience under such conditions, and pass on the information received first hand from a reliable technician; but no guarantee is made as to the absolute accuracy of the report. It is known definitely, however, that such fading does take place, and that early development is recommended under these conditions.

We have already discussed the sensitivity specks which occur within the silver-bromide lattice. While these specks are said to be free atoms of metallic silver by some and silver sulfide by others, evidence indicates the silver theory is the more acceptable. Whichever may be the truth, after exposure we have an emulsion in which the silver bromide grains contain development nuclei which are probably nothing more than sensitivity specks whose growth have been stimulated by light action. At any rate, we do know that the development of a grain consists of a silver growth from these centers and not from the grain surface upon which the developing solution first falls.

One thing which is of interest has already been mentioned in passing, namely, that when the developing solution acts upon a developing nucleus, the surrounding silver bromide gives up its bromine and becomes silver; then all bromide grains touching that silver are in turn reduced to silver, and the process continues until all of the silver bromide in physical contact has been changed to silver, regardless of the space distribution of the developing nuclei. This accounts for the fact that an unexposed grain of silver bromide in actual contact with an exposed one will be developed just as though it had in fact been exposed.

Briefly, then, exposure to light produces internal changes in the silver-bromine relations which cause the reduction to metallic silver to occur under the stimulus of a chemical bath commonly called the developer (Fig. 9). This is a phase which will be discussed later.

We have already considered the differences in emulsions as regards their reaction to color. We have described the color-blind, ortho, and pan emulsions, and have noted that the extension of color sensitivity beyond the blue has been accomplished by the use of dyes. The exact action of the dye is still a matter of difference, but it seems certain that there must be an absorption of the dye by the silver bromide molecule. There have been arguments in favor of a fluorescent action, similar to the action of the intensifying screen in X-ray work; but this is hardly tenable because some excellent dyes do not fluoresce, some highly fluorescent dyes are not good sensitizers, and there is a total lack of accord between fluorescence and sensitization. On the contrary, the dye has some effect which is not, strictly speaking, a chemical one.

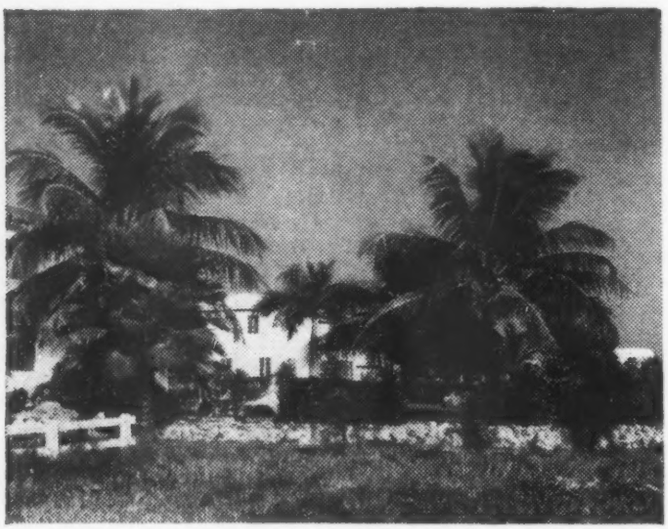
While guessing is popular, I will add my guess to the lot, just for good luck. There is an excellent basis for the fluorescence theory, and the lack of accord may well be due to the fact that the researchers have given too much importance to "visual" effects and have forgotten that there is not necessarily any direct connection between visual and photographic results.

Fluorescence is very closely akin to "heterodyning" in radio reception; that is, two different frequencies beating against one another will produce a third frequency different from both, and equal to either the sum or the difference of the originating frequencies. Fluorescence as commonly known is the production of visible light produced by the impact of invisible radiation upon various substances. There is no reason to doubt that there is an abundance of "invisible fluorescence." It is known that the visible effect may be of greater or less frequency than the stimulating radiation. Therefore, just as we have ultraviolet producing red, yellow, green, and blue fluorescence in the visible region, it is quite possible that visual red may produce an ultraviolet fluorescence when striking a red-sensitizing dye, thus giving high red sensitivity.

But here again, if we accept such a theory as possible we must remember that we do not have any kaleidoscopic play of color, but just as in radio we have one frequency to which the silver bromide grain is sensitive—just as a glass goblet may be shattered by a high note from a violin—and we have heterodyning agencies which take other frequencies and change them to the critical one. The result is that we have a physical change taking place in response to a critical period of vibration, a phenomenon which is familiar to every-

one. Remember how you used to make the piano "A" hum by sounding the same "A" on a violin?

If this is true, it should also be true that harmonics of this critical frequency would have similar action. We find that many of the higher frequencies have strong photographic action, as in radium emanation, X-rays, and so forth; and we find a more or less period-



Normal effect of radiation from visible spectrum on pan film.

ical variation in the sensitivity of such reactions. When we consider that we have not a single critical frequency, but a band of frequencies located in the near ultraviolet and visible blue-violet, we have the conditions under which we might well predict the common photographic reactions, using nothing beyond elementary radio theory!

Also, if this is true, it should be possible to sensitize the emulsions to radiation frequencies beyond the visual range, in the direction opposite the ultraviolet. In short, if our efforts at sensitization stop with the visual band, then there is a direct connection between photographic effect and the visual one. On the contrary, if the sensitization covers the visual band and then continues over into the invisible, we have perfect evidence that we are working purely with frequency, and that the coverage of the visual band is accidental, in one manner of speaking.

In actual practice sensitizing dyes or "heterodyning dyes" will sensitize the emulsion so that the sensitization falls short of the visual range, or the sensitization will fill the visual range and go on into the infrared to a greater or less distance. Moreover, the emulsion can be sensitized so that it is not sensitive to the green or red, but is highly sensitive to the infrared; not only this, but the frequency within the infrared to which the emulsion will have peak sensitivity may be chosen at will. Of course, as this does not include any actual change within the emulsion but is only a method of using the known laws of wave mechanics, the frequency to which the emulsion is inherently sensitive will not be changed. The emulsions sensitive to infrared, therefore, are still highly sensitive to blue and violet, but not to green or visual red. Thus, when making use of this type of film it is customary to remove the blue-violet frequencies from the light which falls upon the emulsion, leaving only the invisible infrared. This is done by a filter which appears perfectly transparent to the eye, and is orange or red in color. It is effective simply because its sole purpose is to remove the blue and violet. This point brings up the question of filters.

The subject of filters is too broad to be discussed thoroughly here. It is sufficient for our purposes to state that photographic color filters have just one function, to suppress certain groups of frequencies. Thus the yellow filter suppresses the blue and violet frequencies; the yellow-green suppresses the blue, violet, and red; and so forth. The filter is simply what its name indicates; it is a device to filter out from the used light certain unwanted frequencies. And as frequencies are interpreted by our eyes as color, the general effect of the filter is translated into color differences.

There is one point which should interest the inquiring amateur; the emulsion is not inherently sensitive to red. The ordinary emulsion can be exposed and then developed in red light without the emulsion being further affected. This same emulsion can be treated with a red-sensitizing dye, then exposed in a camera whose lens is covered with a red filter, and thus exposed to nothing but red light; and image is formed as readily as when white light was used in the first place.

In terms of mechanics we have here a case in which a lattice is disarranged by vibration of frequency A, but is not in any way affected by frequency B. Then something is interspersed within the lattice and suddenly it becomes very sensitive to frequency B. Either of two things may have happened:

1. The new material introduced may be affected by the second frequency and then have transmitted its response to the lattice.
2. The newly introduced substance may have some property of absorbing frequency B and as a result emitting frequency A to which the lattice is sensitive.

If we accept the first theory we must believe that the sensitizing dyes are themselves light-sensitive, otherwise the continued impact of light would bring about the characteristic reaction and bring it to its

Effect of infrared radiation on film sensitized to the infrared.

termination before the use of the dye. But if the second case is true, then the property of the foreign substance is not a reaction which starts, runs its term, and terminates, but it is a reaction which takes place as often as the stimulus is applied.

So here is the presentation. We shall not carry it farther because it is not offered as proven fact, but simply as an hypothesis which may give food for thought to those interested.

But of what practical use is a knowledge of sensitization to the photographer? Already we have given too much time to interesting theory. We must go on to more practical matters.

Summary.

Thus far we have, at the risk of some repetition, tried to acquire some familiarity with the nature of the gelatino-bromide emulsion and its reactions as applied to photography. The repetition has been necessitated by the desirability of developing the various factors in more or less parallel relationship. Now let us summarize the facts which have thus far been developed.

1. The gelatino-bromide emulsion is principally a physical suspension of silver bromide in a vehicle of gelatin.
2. Gelatin is physically desirable because of its physical factors of pellicle formation, transparency, and its habit of swelling when moistened, only to dry back to its original shape when the water is removed.
3. Gelatin produces a more sensitive emulsion than other colloids, principally because of the presence of natural oil of mustard.
4. There is a spontaneous, incipient breakdown of the silver bromide with the result that "sensitivity specks" of silver (silver sulfide) are deposited within the molecule.
5. There are small percentages of silver iodide present in the emulsion and traces of silver chloride which result from the presence of chlorine in the water and as an impurity in the other chemicals.
6. The impact of light upon the emulsion increases the tendency of the exposed grain to break down with a probable increase in the mass of the sensitivity speck.
7. A single grain cannot be partially developed. If any part of the grain is exposed the entire grain develops. Any unexposed grain in physical contact with an exposed one will also be developed.
8. Photographic differentiation is obtained through the exposure of a greater or lesser number of grains per unit area.
9. The natural emulsion is inherently sensitive to ultraviolet, visible violet, and blue. Sensitivity to longer wavelengths is imparted by the use of sensitizing dyes which probably act through a quality of the general character of fluorescence.
10. Changes after exposure are normally toward greater image density, but in some cases the reverse may be true.

CHAPTER II

DEVELOPMENT OF THE IMAGE

The Reducing Agent—The Preservative—The Accelerator — The Restrainer — The Characteristic Curve — Waste Products—Chemical Fog—Desensitizers—Non-Chemical Factors — Fixing — Washing — The Negative

THE image obtained by exposure is, as has been stated, invisible. To produce the visible and printable image, the exposed grains must be reduced to their silver state. This is done by the use of a class of chemicals known as **reducers.** It is of the greatest importance that these reducers or developing agents should never be confused with the silver-dissolving chemicals used to reduce the density of the developed negative. It is unfortunate that the chemical term and the physical one should be identical, but as a rule the way in which the word is used will serve to identify the "reducer" which is under discussion.

Not all reducing agents are suitable for photographic development. Some of them will not develop the image at all; others are so active that they reduce all the grains of the emulsion with no regard to any preceding exposure to light. Obviously, both of these groups are useless. There are still others which tend too much toward one or the other of these two groups to have any practical value. This leaves us a small group of agents which are suitable for developing the image. These include such familiar agents as **metol, hydroquinone, amidol, glycin,** and others.

It might be said that those reducers which develop regardless of exposure have great developing or reducing power, while those which will not develop at all have little reducing power. Instead of using just these terms however, let us say that the very active developers have a high **reduction potential** while the weaker ones have a low reduction potential. Thus, when you meet these terms, remember that they can be simply (and not inaccurately) considered as referring to "powerful developers" and "weak developers." We do not use these latter terms because it is possible to make a strong developer using a low potential reducer, and conversely to make a weak developer from a high potential reducer. Ordinarily the terms "strong" and "weak" are limited to references regarding the concentration of solution.

You will remember that a statement was made to the effect that a certain "quantity" of light must fall upon a silver grain to make it developable. That is true; but how great or how small that quantity depends not upon the bromide alone, but also upon the developer to be used. High-potential developers will reduce grains which received so little light as to be unaffected by low-potential developers. This is to be expected when we consider that our chosen reducers are not a sharply isolated group, but start near the limit of those which will not develop at all and range upward next to those which will reduce regardless of exposure. Our useful developers, therefore, will all stand midway with some tending toward one extreme, others toward the other. In consequence we should expect some characteristic action just like that which was stated at the beginning of this paragraph.

You often hear the statement made, "You cannot develop an image which has not been impressed by light." Now that is very true if we interpret the word "light" broadly enough and if we specify a recognizable image of a real object; but there is the corollary not so widely known, "With a high-potential developer you can develop an image which is too weak to be developed by a low-potential one." Here we have the first step in that strong bond which constantly reappears between exposure and development. So close is this bond that it is impossible to make any statement about either (except the broadest generalities) unless the statement includes the relationship of the other factor. Thus, any correct exposure can only be correct relative to a given development. Conversely, any given development is correct only in relation to the given exposure. The attempt to create two systems of independent exposure and development has produced a condition of havoc in the ranks of amateur photographers. The only thing which can be done in this

respect is to assume some optimum exposure and then give the related development. Naturally the amateur assumes that this exhausts the possibilities of both, when nothing could be much farther from the truth.

We have assumed that actual physical impact of light produces the initial breakdown of the bromide. We know as a matter of experimental fact that an exposed emulsion weighs more than an unexposed one, the difference being assumed to represent the weight of the light absorbed. But we cannot imagine any disturbance taking place in the developing solution which would repeat the impact to a magnified degree. No, the chemicals of the developer penetrate the gelatin. As the developer solvent is water, the gelatin will swell to a marked extent, but upon later drying it will return to its original position. **This is of the utmost importance.** It permits easy penetration of the solution without permitting any distortion of the image through regional displacement of parts of the gelatin.

Having penetrated the gelatin, the solution dissolves the silver bromide, and the solution **within the gelatin** becomes a fully saturated solution of silver bromide. When this happens, the silver is deposited upon the sensitivity specks, and the process continues until complete deposition has taken place. Students of elementary chemistry will remember that it is possible to make saturated solutions of many salts. These will remain liquid until a crystal of the same salt is introduced; when that is done there is a rapid crystallization of the salt. They also know that when the solution is supersaturated (as when a hot saturated solution is allowed to cool) the introduction of the single crystal will sometimes result in the instant crystallization of the entire bulk of solution.

Here we see the actual role played by the sensitivity specks in the film emulsion. The solution of bromide will not give up its silver in the absence of some nucleus upon which to deposit it. This not only explains why the nuclei are necessary, but it also explains why development proceeds from the sensitivity speck outward. It also gives us a pretty good idea as to why the developed grains do not conform identically to the pre-existing grains of silver bromide.

Naturally, solution starts as soon as the developer penetrates the gelatin. Inasmuch as it penetrates the upper strata of gelatin first, it may logically be assumed that grains in the top layer may be almost full grown before some of those in the bottom layer have reached full solution. Thus, development is a progressive reaction from the uppermost layer down through the emulsion, and in each "stratum" it is a progressive reaction from penetration, through solution, to deposition of the metallic silver.

This process of development hints at electrolysis, and it may be noticed that when substituting one alkali for another in the developing bath, the ratio of substitution is based neither upon chemical composition nor upon the heat developed in neutralizing them. It is based on the production of solutions wherein the same unit resistance will be formed; moreover experiment shows that the rate of development in a bath is proportional to the electric resistance of the solution. This may be contested, as the tendency of modern science is to reduce everything to electrical terms. The fact was recorded by Arthur von Hübl in 1901.

Suppose we consider each individual grain as a unit in which electrolysis is taking place. If the electrolysis is continued for very long there will be an accumulation of oxygen at the anode which will insulate it, and further electrolysis will not occur. However, if some chemical is present which will combine with the oxygen (i.e., a reducer), this oxygen will be removed and the metallic silver can be deposited by electrolytic action. We already know that efficient developers are reducers, so it is reasonable to conclude that here is an hypothesis which is at least tenable.

So much for the generalities of development. Our next interest is in the direction of specific development as practiced in ordinary photographic darkrooms.

The Reducing Agent.

As has been stated, the actual developer is a reducer and ordinarily an organic compound of somewhat complex type. Among the simpler metal-organic compounds is **ferrous oxalate,** once a favorite developer but now rarely used. Among other older developers are **adurol,** (chlorhydroquinone), **azol, diogen, dianol, eikonogen, imogen sulfite, kachin, ortol,** and **quinamet.** It is doubtful if any of these except the first could be found on the shelves of a modern photo shop. It is more to the point if we give our attention to developers now commonly in use. In addition to the chemical characteristics of the various developers we shall note their relative developing potential.

Of the developers now in common use, no doubt **metol, hydroquinone,** and **pyrogallol** (pyro) exceed all others in popularity, with **paraphenylenediamine** and **glycin** next in their roles as finegrain developers, and **amidol** in sixth place as a special but universal agent.

Pyrogallol. Commonly known as **pyro,** and erroneously as "pyrogallic acid." 1-2-3 trihydroxybenzene, $C_6H_3(OH)_3$. Reduction potential, 16. This is one of the oldest developers, having been used as early as 1851. Pyro produces a metallic image accompanied by a stain which improves the printing quality and acts in some measure to mask graininess. Although disliked on account of its propensity to stain, it is probably the foremost developer available in the chemical group for the production of negatives of superb quality.

Metol. Commonly sold under this and other trade names (the name "metol" is itself a patented trade name) also sold as Elon, Pictol, Satrapol, Veritol, Rhodol, and so forth. Paramethylaminophenol sulfate. $C_6H_4(OH)\cdot(NH\cdot CH_3)\cdot\frac{1}{2}H_2SO_4$. Reduction potential, 20. Gives negatives full of detail but inclined to thinness; very rapid in action, and commonly used in conjunction with a slower acting developer.

Hydroquinone. 1-4 dihydroxybenzene. $C_6H_4(OH)_2$. Reduction potential, 1. A slow, clean-working developer, which loses its active quality at temperatures below 60° F. As its low potential prevents it from affecting emulsion grains which have received weak light, this developer used alone is excellent for high contrast work such as line copies. In ordinary work it is usually combined with metol to form a "universal" type of developer.

Paraphenylenediamine. 1-4 diamino benzene. $C_6H_4(NH_2)_2$, also used as the hydrochloride $(C_6H_4(NH_2)_2\cdot 2HCl$. Reduction potential, 0.4. Used alone it only partially develops each grain and does not provide sufficient contrast. Used with an alkali it is more energetic but does not produce sufficient shadow detail owing to its low potential. These defects are usually compensated for by adding another developing agent such as metol or glycin. Paraphenylenediamine is not a new developer, having been used since 1888, but re-

cently it has come into vogue as a finegrain developer. There is some question as to the practical value of this agent inasmuch as the fine grain is obtained at the cost of shadow detail and other desirable qualities.

Glycin. Parahydroxyphenyl glycin, C_6H_4 (OH)-(NH·CH_2COOH). Reduction potential 1.6 Glycin deserves more attention than has been given it. By itself it is a slow but satisfactory finegrain developer, producing good, clean negatives of excellent printing qualities. It is somewhat difficult to prepare, but a favorite among those who have learned to use it. Now restricted almost entirely to its role as one constituent of finegrain developers.

Amidol. 2-4 diaminophenol-di-hydrochloride, C_6H_3-(OH)$(NH_2)_2$·2HC1. Reduction potential 30 to 40. Amidol is unique in that it will function without the presence of an alkali added to its solution. Not widely favored because of its poor keeping quality, it has high favor among its adherents who claim that its action is superlative. Used by many outstanding pictorialists for both negative and positive development. When stale or even when made up with old sulfite, the image lacks brilliance. To get results from this excellent developer, **fresh** sulfite must be used, and the solution itself must be **freshly mixed.**

There are a few other developers which might be mentioned, but among them perhaps there is only one which has any real advantage. This is **Paraminophenol** (paramidophenol), which is usually sold as the hydrochloride C_6H_4(OH)(NH_2)·HC1. This is more commonly known by the trade name **Rodinal,** which is a concentrated solution to be diluted for use. Kodelon is the trade name for the oxalate of paraminophenol. Clerc[3] credits J. Desalme with recommending the use of the tartrate so that concentrated solutions can be made without the use of a caustic alkali. Stock solutions of Rodinal and its imitations are made with caustic alkalis, although the alkaline carbonates are to be preferred. Because of the reactions which take place, the use of carbonates with this developer is limited to the preparation of solutions of working strength.

It is well known that a developing solution contains a small amount of the actual reducer as compared with the amounts of other chemicals used in the same solution. Each of these has a definite purpose, and the characteristics of the compounded developer can be profoundly changed by alterations in the proportions of these constituents and by changes in the concentration of the solution.

The developer has a certain function to perform; it must reduce all of the silver bromide grains which have been exposed to light and not affect those which have not been so exposed. Actually, some grains which have not been exposed are developed, and some which have been exposed do not develop. Therefore, the practical developer is one which will closely approximate the ideal. To make such a solution, certain chemicals are added to the reducer. Ordinarily these accessory chemicals include an alkali which affects the gelatin so as to permit rapid and easy access of the solution throughout the gelatin structure; a preservative which by a relatively greater affinity for oxygen prevents rapid deterioration of the developer; and a restrainer which is used to cut down the amount of "unexposed" development and thereby prevent fog or "veil." The chemicals ordinarily used are **sodium carbonate, sodium sulfite,** and **potassium bromide** respectively. Although these chemicals perform their functions, we should recognize certain facts regarding them, so that in our eagerness to take full advantage of their qualities we do not ruin the developer.

[3] "Photography: Theory and Practice," by L. P. Clerc.

The Preservative.

Although sodium sulfite is added to the developer to prevent too rapid oxidation of the solution from contact with the air, it is not added in any haphazard manner. The factors which affect the amount of sulfite to be used include:

Nature of the developing agent.
Nature of the alkali used.
Degree of concentration of the solution.
Degree of keeping quality desired.
Temperature of the developing bath.

For example, very little sulfite is necessary with glycin, which does not oxidize readily, nor is much needed

Negatives developed in too contrasty a developer produce prints with burned-up highlights and no shadow detail on normal paper.

with a developer like paraphenylenediamine whose oxidation products are colorless. When a heavily oxidizing developer such as pyro is used, a relatively large amount of sulfite is necessary to hold the staining power to a minimum.

Likewise, developers which contain strong caustic alkalis such as sodium hydroxide oxidize more readily than those made with the carbonates, and so require the use of a greater amount of sulfite. In the matter of dilution, the proportionate amount of sulfite used in a dilute developer is greater than in a concentrated one.

However, these conditions are subject to other conditions. Although not common practice, it is advisable to make all developing solutions fresh, **except** in the case of those which have special properties which are gained only with aging or ripening. For a freshly made developer which is to be used and discarded, the sulfite concentration need not exceed one per cent, or about four and a half grains to the ounce. According to Mees,[4] the solubility of silver bromide is least at this concentration, and the chances of chemical fog are lowest. For developers which are to be kept for a time, particularly in partially-filled bottles or open tanks, the sulfite content must naturally be increased. Another factor which calls for added sulfite is high temperature. This is because a warm solution tends to oxidize more rapidly than a cool one.

Silver bromide is soluble in sulfite, and so the sul-

[4] Mees and Piper, *Phot. Jl.*, 51, 1911.

fite content of a developer produces an action similar to that encountered in physical development. The silver is redeposited upon the tank or film racks and also upon the image which is developing. This deposit strengthens the image; but when there is no image in the immediate vicinity, such as in deep shadows, the free silver is deposited upon the face of the film producing a **chemical fog,** and its formation is hastened by old or warm solutions. This property of sulfite, by virtue of which it attacks the silver bromide grain, is used in some developers such as the borax type to prevent grain clustering of the type which is responsible for graininess. In addition to preserving the activity of the developing agent itself, the sulfite usually prevents any deep discoloration which might stain the gelatin during the process of development.

The Accelerator.

Because the role of the alkali is so complex, it is usually stated that the alkali brings about an incipient destruction of the gelatin structure to permit a ready penetration of the developing solution. While this may be figuratively true, to a degree, it is actually a misrepresentation of fact. A pure solution of hydroquinone in water will not produce development, but the addition of as little as five per cent of sodium hydroxide will produce an acceptable image in two and a half or three minutes. Some of the developers will, after long immersion, produce an image if sulfite is added to the solution, but development as we understand it is usually dependent upon the use of an alkali. This may be the hydroxide, the carbonate, or a less destructive agent such as tribasic phosphate.

We have already discussed the probability of the electrolytic theory of development. If that is accepted, we have in the alkali the necessary electrolyte. This is one role which may well account for the tremendously increased rate of development in the presence of the alkali. This gives us a different picture of the "destructive" action of the alkali. It is true that the hydroxides will actually produce some disintegration of the gelatin if their action is prolonged, but a five per cent solution of carbonate will not cause gelatin to swell as much as will pure water, while a fifteen per cent solution of carbonate causes only about one-fifteenth of the swelling produced by the five per cent solution. As a note of interest, it may be added that saturated solutions of alkaline carbonates have been used to produce an extremely rapid drying of gelatin films saturated with water. At the same time it must be remembered that the carbonate does greatly accelerate the penetration of the developing solution into the gelatin of the emulsion.

The alkali serves another purpose in the developer. When the silver bromide grain is reduced to metallic silver, bromine is freed. This takes up hydrogen to form hydrobromic acid, and if the alkali were not there to neutralize the acid, development would shortly stop. Even this does not terminate the role of the alkali. When the developer is in the form of a salt, the alkali acts to release the active base, and when the developer is one of the phenols it reacts with the phenol or some part of it to form a salt. Thus we do not necessarily make use of the developing agent which is added to the solution, but some other form of it which in many cases is not directly available as a separate chemical.

It would seem logical to make use of the strong alkali, such as the hydroxide, and dilute it to the strength necessary to procure the necessarily weak action. Such reasoning is logical, but it ignores the reservoir action of the carbonate. The carbonate in solution dissociates into the bicarbonate and the caustic form, so that while the weak caustic would soon be used up, the carbonate provides a constant source of supply for a small amount of the caustic.

The Restrainer.

We have already seen that there are factors which tend to produce developed grains of silver where there was no exposure to light. This tendency may be controlled largely by the use of correct amounts of preservative and accelerator, and making use of an alkali which is not too energetic, as well as by the choice of some reducer which has slight fogging tendency.

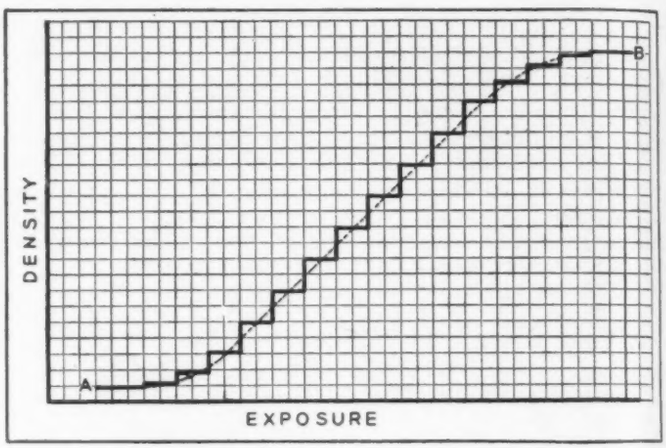


Fig. 10. Curve AB, based on set of steps, represents negative density produced from series of equally increasing exposures.

In addition, most developer formulas call for the use of a chemical restrainer, usually potassium bromide. The value of bromide in a developer is sadly overrated and widely misunderstood. The first fact to remember is that the absolute minimum amount of bromide which will serve is the best quantity to use.

There is a popular concept that certain developers will increase or decrease the speed factor of an emulsion. As this factor is an inherent quality of the emulsion, such a concept is the height of absurdity. The truth is that some developers are more efficient than others, and therefore less exposure is required when they are to be used. However, as long as the real meaning of the term is understood, we may say that the use of bromide in a developer is deliberately inviting a loss of emulsion speed. In other words, if three negatives are exposed and each one given half the exposure of the preceding, it would be possible, by adding enough bromide, to obtain three practically identical negatives from the three exposures.

If the bromide caused a proportional loss of tone value it would not be so bad, but it acts just like underexposure, that is, the shadow detail suffers while highlights are hardly affected at all. So marked is this effect that many old-time photographers would load up the developer with bromide after making an overexposure and thus obtain a passable negative.

The Characteristic Curve.

In Fig. 10 is shown a curve AB which represents negative density produced under certain conditions from a series of exposures. This curve has drawn across its straight portion a set of steps, each showing the relative density for an equally increasing series of

exposures. It will be seen that at the beginning and end of the curve the steps have little height. That is, there is only a slight increase in density every time the exposure is increased by a definite amount. In the central or straight portion of the curve the steps are about as high as they are wide, showing that there is an increase in density corresponding exactly to the increase in exposure. As the portion of the "curve" drawn through these steps is a straight line, this is known as the **straight line portion of the characteristic curve.**

Interpreted in terms of a picture, the straight line portion of any exposure is that range of tones which

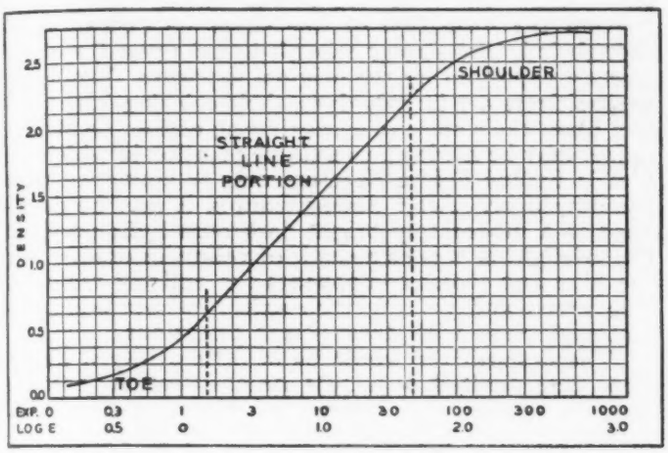


Fig. 11. The characteristic curve, showing toe, straight line portion, and shoulder. It is indicative of a series of steps.

are proportional to the intensities of the light in the original subject; that is, double intensity will produce double density, and so forth. Ordinarily the actual steps are not shown in drawings of characteristic curves (Fig. 11), but the straight line portion is recognized as indicative of the series of steps.

When the characteristics of an emulsion or of a developer are to be investigated, a film is given a series of known exposures. As a rule the exposures advance in geometrical progression, that is, 1, 2, 4, 8, 16, etc. After the exposure has been made, the negative is developed and the densities are read. As density is a logarithmic factor, the logs of the exposures are used as a basis for the graph.

In the underexposed part of the film—that is, the shadow tones—the increase in density is comparatively slight for equal increases in exposure. This forms a curve known as the "toe" at the bottom of the graph. Farther along, each increase in log exposure produces the same degree of increase in density. It must be noted that the increase in density need not be equal to the increase in exposure, although it may be so. When this happens, the straight line rises at a 45-degree angle, and exposure and density are exactly proportional. However, the straight line may lie at any angle to the base, and the steeper this angle the greater will be the **contrast ratio or gamma** of the negative. At the top of the graph the line breaks to make a curve opposite to the toe, because the highlight tones are similar to the shadow tones in being only slightly separated. This portion of the curve is known as the "shoulder." In Fig. 11 the region between the dotted lines is the straight line portion of the curve. Later we shall see how gamma is derived from this characteristic curve.

If characteristic curves are made of negatives developed in solutions carrying different amounts of bromide, the gamma will not be materially affected, but there will be a constant regression of inertia just as you would find if you used negatives of constantly decreasing sensitivity. At the same time the changing shape of the toe of the curve will tell the story of lost shadow detail (Fig. 12).

Most modern emulsions contain a minute quantity of soluble bromide and are best developed in solutions which have no added bromide. The best guide to follow in this respect is the formula provided by the manufacturer of the film. He knows what his emulsion contains, and his recommended developer is balanced to his own emulsion. So, if you find that the ABC developer works excellently with the ABC films, do not assume that therefore the ABC developer is best for XYZ films also.

Many amateurs lose sight of the fact that during development the solution takes up some additional bromide, the quantity increasing with the emulsion area which has been developed. Not only this, but oxidation products of the developer also accumulate, so that we have a definite limit to the developer life.

Waste Products.

When a portion of the image is developed, the solution which has done the work has taken up additional bromide and oxidation products which make the solution heavier than the original and also give it a retarding action as regards subsequent development. If the negative is being developed in a vertical position in a motionless tank, the solution which has developed the image at the upper part of the negative sinks downward because of its increased density. This carries it over the lower part of the negative where it retards development. However, as it sinks, the lighter fresh developer flows in at the top and there development proceeds normally. As a result, the negative presents a constantly decreasing density from top to bottom.

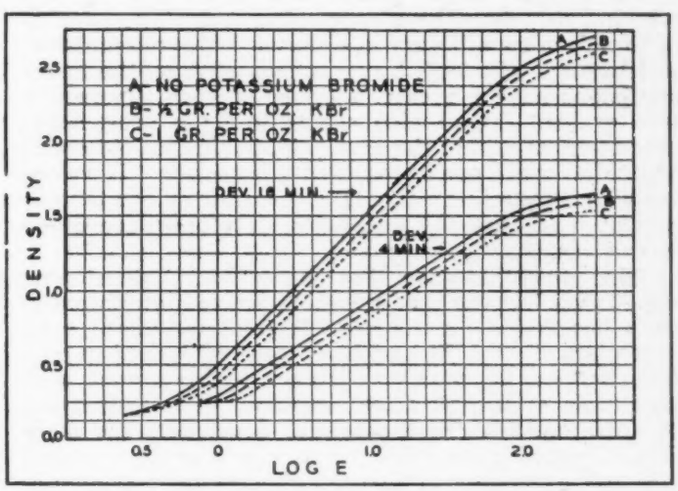


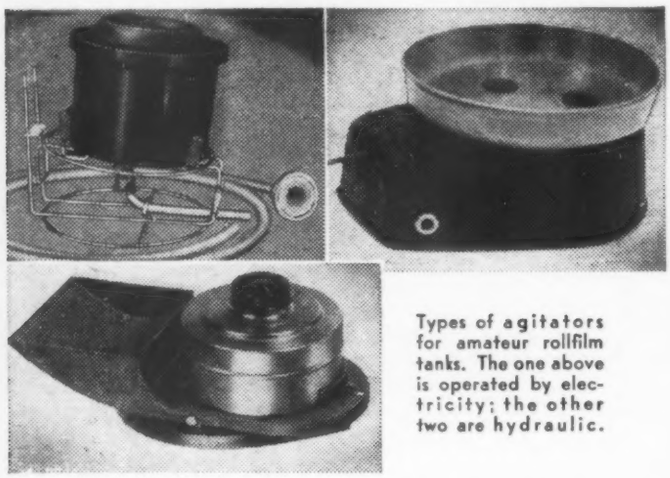
Fig. 12. When bromide is added to a developer, relative changes are unaffected, but it acts like a corresponding underexposure.

If there are obstacles to free circulation such as perforated metal racks or even perforations in the film, the variable action of the charged developer will be seen as streaks across the negative.

If the negative is developed in a horizontal position, the diffusion of the waste products away from light colored objects (dense negative areas) will inhibit development at the border of the area and surround the light object with a definite black line. If the original subject was made up of patches of various sizes but all of intermediate tone value, the smaller

patches will develop to the greatest density, and in all patches the edges will have greater density than the center.

When some means is used to keep the developer agitated during the process of development, these faults are reduced to a degree where they are of no



Types of agitators for amateur rollfilm tanks. The one above is operated by electricity; the other two are hydraulic.

moment. The agitation accelerates development by providing fresh developer to the negative all the time, and it also prevents loss of contrast and dropping developer potential, both of which would be serious in a stagnant developer.

Chemical Fog.

We have mentioned, from time to time, the development of unexposed grains of silver bromide. The cause seems to lie in the fact that in the manufacture of the emulsion there are some grains which are far more sensitive than others, and these will develop whether they have been exposed or not. The number of these grains will vary in different types of emulsion, and usually, although by no means always, the faster emulsions have a greater number of such supersensitive grains. There also seems to be a progressive deterioration within the emulsion, so that an old emulsion is far more apt to fog than a fresh one. Developers which contain an excess of alkali or sulfite tend to produce excessive fog, and warm developers are worse in this respect than cool ones.

One might assume that low-potential developers would give less fog than the more active high-potential ones, but this is not the fact. Amidol and metol, with potentials of 30 to 40, and 20, respectively, tend to give less chemical fog than do pyro and hydroquinone with potentials of 16 and 1 respectively. It is interesting to note that with high-potential developers the addition of bromide restrains fog to a greater degree than it does the image, so that bromide may be used advantageously, whereas with low-potential developers it tends to do more harm than good.

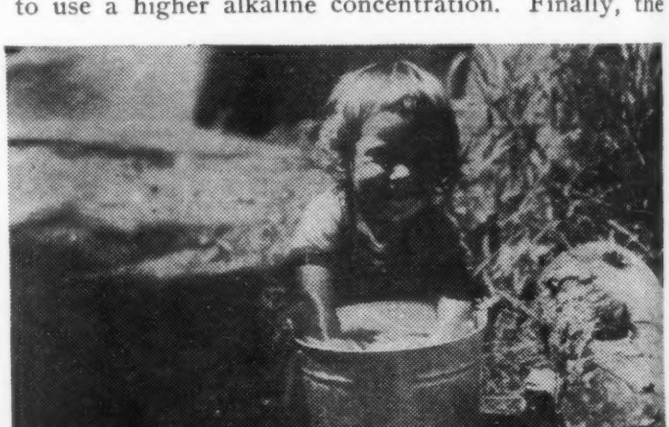
Strangely enough fog is encountered more often in weak than in concentrated developers, while the removal of a negative from the developer before development is completed (as in developing negatives by inspection) almost invariably leads to fog. An unexposed emulsion when developed exhibits more fog than does an exposed one, but even in the exposed film there is often sufficient fog to decrease the contrast and in some cases even to mask the more delicate detail in the image. Because there is a great amount of bromide released in the highlights, there is very little fog here, but in the weaker shadows the fog piles up, and this uneven accumulation of bromide tends to flatten the contrast which otherwise would be obtained.

There are some desensitizers which apparently have the power to eliminate chemical fog, and to do this without any marked loss of speed or change in contrast. Many amateurs make a practice of using desensitizers for all-dark development simply because of the clean, fog-free negatives which are obtained.

Desensitizers.

This class of chemicals act as narcotics upon the emulsion. According to Dr. Lüppo-Cramer, the desensitizer has weak oxidizing power which enables it to prevent the formation of free silver by exposure, although it is not strong enough to act upon the silver already deposited by the original exposure. While the desensitizers are largely dyes, their coloring has no effect upon their specific desensitizing action. A desensitizer may be made up as a single solution in which the film is bathed before development, or combined with the developer. After desensitization it may be developed in a moderately bright darkroom light provided the safelight is of such a shade of yellow or orange that the blue and violet components are entirely removed. The green and yellow-green safelights are not satisfactory for use with desensitized emulsions.

The desensitizer would be of little utility if its action were limited to actual desensitization, because there is seldom any reason for visual development. However, there are other reactions of interest which make the desensitizers of great value. First of all there is the tendency to inhibit fog which is usually so great that the negatives appear to be totally free from fog. Then there is the effect upon the developing agent. With a desensitizer it is possible to push development far beyond the usual limit, and it is possible to use a higher alkaline concentration. Finally, the

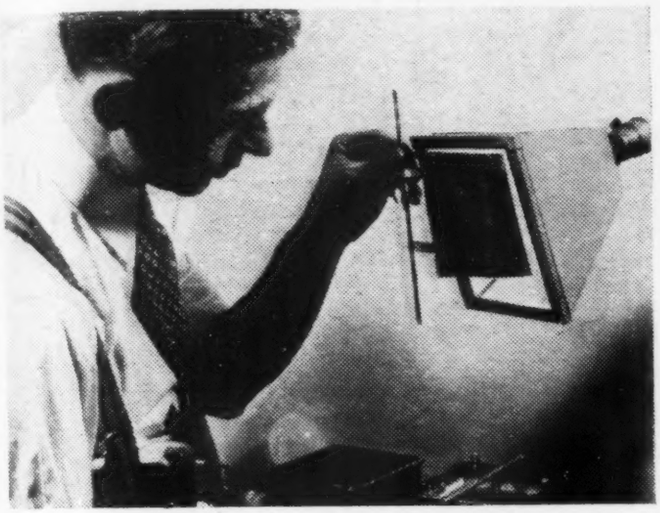


Degraded print made from a negative marred by chemical fog.

typical reaction of the reducer itself is often altered; hydroquinone, for example, acquires properties which make it strongly resemble metol.

There is no freedom of choice as to the method of using the densensitizer. **Safranine,** one of the most popular desensitizers, is precipitated by developers of the polyphenol group (pyro, hydroquinone), and even with other developers it cannot be added to the stock solution, but only to the working bath in proportion of about one part safranine to two thousand parts of developer. This indicates that the safranine group of desensitizers should be used as a preliminary bath and

not in the developer itself. Among the desensitizers used, safranine probably leads the field. Others include **auramine, chrysoidine, fuchsine, aurantia, pinacryptol** green, and **basic scarlet N.** Aurantia is poisonous to some people if allowed to come into contact with bare skin. If it is used, rubber gloves or developing racks or tongs should be used. Pinacryptol green is of secret composition. It acts somewhat like methylene blue mixed with acridine yellow and tends to increase fog with certain emulsions instead of reducing it. Basic scarlet N, is a mixture of approximately equal parts of



After desensitization, film can be examined in orange safelight.

safranine and chrysoidine. It has the desensitizing power of safranine, but does not stain the fingers and emulsion to any degree.

These desensitizers are used in dilutions of 1:1000 to 1:5000. Weaker solutions lose their desensitizing power rapidly. At 1:5000 safranine, pinacryptol green, and basic scarlet N remove about ninety-nine per cent of the original sensitivity of the emulsion, while in dilutions of 1:1,000,000 the reduction in sensitivity is only about ten per cent, which is a reduction of no practical value.

It is important to observe that desensitizers do not actually remove all response to light, but only reduce it to a practical degree. For example, if 1/100 second exposure to a given light is sufficient to fog a film completely, one second will produce the same result after the film has been "desensitized" in a 1:5000 solution. Even after desensitizing, films must be handled with care, because they **can** be fogged. Basic scarlet N is one of the most advantageous desensitizers for the experimental amateur. It is made up in a 1:500 stock solution and diluted 1:10 for use (1:5000 working strength). Formalin added to the stock solution in a strength of two-tenths per cent will give the stock solution excellent keeping qualities.

Non-Chemical Factors.

There are other factors affecting the development which are not strictly speaking chemical. These factors include the important ones of **dilution** and **temperature.** The effect of dilution depends upon the developer itself. A slight dilution in any case affects the speed of development and the formation of fog, while considerable dilution may affect the character of the image. This is apparently a compound factor of the concentration of the bath itself and of the rate of oxidation encountered. For example, when a non-oxidizing developer such as glycin is used, a half-strength developer used twice as long will give a result which is almost identical with the normal. Here the effect of dilution is least, its only important complement being the increased time of development. In other developers which oxidize in air readily, this oxidation causes a loss of strength, and the time complement must be made disproportionately large. Dr. B. T. J. Glover, in 1923, reported that if Rodinal were used at 1:100 instead of the normal 1:20 dilution (that is, a further dilution of 1:5), the time instead of being increased five times, would really demand an increase of from six to nine times.

As the dilution is increased, there is a further change which is not based in any way upon the concentration-time complement. Development progresses because the water of the solution carries the developing ingredients into the gelatin. As the developer is diluted, each unit volume of water carries less and less developer. It is obvious that the developer starts to act, and is neutralized as soon as it strikes the surface of the emulsion, and that penetration is only possible by the action of water carrying reserve developer into the depths of the emulsion.

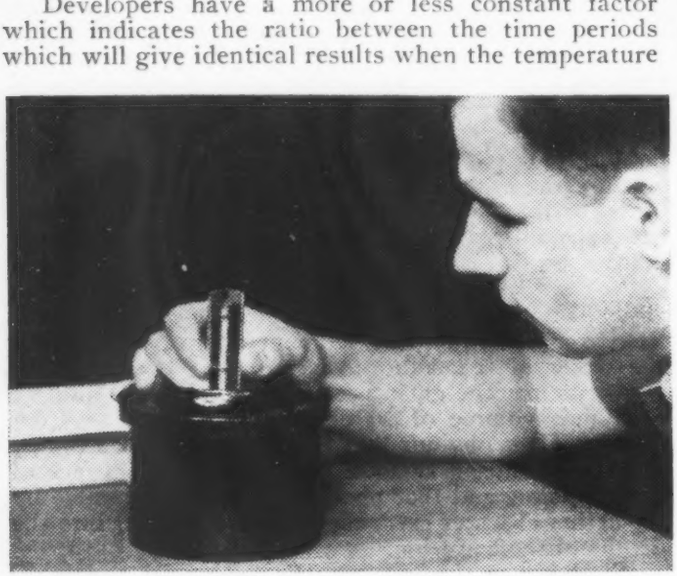
So, because shadow detail is superficial and highlights extend into the depths of the emulsion, a very weak developer will be expended at the surface and all shadow detail will be brought up before the highlights are more than partially developed. This method may be used to reduce the contrast of underexposure without sacrificing any shadow detail which may be there. This is one of the secrets of "developer magic" which isn't nearly as mysterious or valuable as it first appears. In the first place, to get the fullest effect all bromide must be omitted from the developer. Development should be stopped when the shadows have reached their fullest intensity. This means that the highlights are still too thin and the whole negative must then be intensified to bring it up to normal density. The method is of value in reducing contrast, because when development is stopped short of the full time, certain developers will produce a negative which is not equally developed. For this reason low gamma or compression development is far more satisfactory when done with a very dilute developer than when the normal developer is used for a shorter than normal time.

The dilute developer is so effective at times that it has gained a reputation for being a wonder developer. More detail, increased quality, more faithful proportion of tone, and many other wonderful claims have been made for it. If the film is left in the dilute developer for a sufficient time, the highlights would reach the same density as in a normal bath, and the chances for chemical fog in a dilute developer are far greater than in one of normal concentration. The dilute developer does not produce greater detail nor any better quality, except that the patience of the photographer is exhausted before the highlights become clogged, and he is fooled into thinking that he has a non-clogging developer.

Temperature, too, plays an important role in photography. Almost all chemical reactions progress more rapidly as the temperature is raised, but in development we find again the dissimilarity of reaction between the exposed and unexposed grains. As the temperature rises there is an increasing tendency for the unexposed grains to react; that is, the chemical fog increases with greater proportional rapidity than does

the image. This establishes a temperature limit which can be raised by the use of additional bromide in the developer.

Developers have a more or less constant factor which indicates the ratio between the time periods which will give identical results when the temperature



Temperature is an important factor in negative development.

differs by eighteen degrees F. (10° C.). However, these factors or **temperature coefficients** are of little practical value, because in a mixture of two or more different developers, each one retains its own individual coefficient. Thus in the usual mixture of metol and hydroquinone, a very low temperature stops the action of hydroquinone, and the negative has the appearance of a negative developed in metol. At very low temperatures the inhibiting effect resembles the effect of underexposure (and is therefore sometimes used for the development of overexposed films). On the contrary, a warm developer favors the development of underexposed negatives because the temperature rise not only raises the equivalent potential of the developer but at the same time produces a greater degree of chemical fog, and this in turn adds density to the shadows, masking the underexposure effect to some degree.

There is a great deal to be said in favor of the experimenter working with temperature changes, but until considerable experience is acquired it is advisable for the photographer to keep his processing solutions between 65 and 70 degrees F. whenever possible, as this temperature range has been established as the best for general processing.

Minor Factors.

There are still other modifications of the process of development which are used at times, but which lie more or less in the realm of the experimenter. Despite this fact, it must be recognized that many "trick" developers of our day are simply adaptations of these modifications which, although never widely known, have been known to photographic technicians for years. Too often some enterprising individual takes one of these old stunts, incorporates it in a brand new "magic" developer, and promptly makes a fortune. The catch is that every such stunt which is used is available only at the cost of some more valuable advantage.

It cannot be emphasized too strongly that the best developer for any film or plate is the developer which the manufacturer recommends. He is thoroughly familiar with all of the "wonder" developers, and has been for years; but he knows that while they may possess some single advantage, they will never give the all-around, universal satisfaction that his carefully balanced developer will give. To be fair, this has no bearing upon the makers of developing solutions for which only normal results are claimed, and which solutions are carefully compounded of pure ingredients to save the amateur the trouble of keeping a stock of chemicals on hand and compounding his own. Nor is it impossible that something new may be discovered. Our age is an age of discovery, but the chances are that the legion of skilled researchers in the big laboratories will make the discoveries. On the whole, the secret developer should not be accepted until it has proven itself superior in a series of carefully checked, impartial tests. I have yet to find one which will pass such a test without showing signs of being the same old familiar stuff!

Iodides.

There is usually a minute quantity of iodide present in the emulsion. If it is added to a developer to the extent of about one part in a thousand (1:5000 to 1:500) it will cause low-potential developers to accelerate considerably, particularly as regards the time of image appearance. Developers of higher potential, such as metol, show very little response. The action is the same if the iodide is applied as a preliminary bath or mixed with the developer. Details of the action are not known, but Lüppo-Cramer has advanced the theory that the sensitive nucleus has some protective shield removed by the iodide.

Of more practical importance is the fact that iodide will more or less effectually prevent the appearance of black abrasion marks, and to some extent it acts as a preventive against dichroic fog. Among its disadvantages are the lengthening of fixing time, the reduction in sensitivity, and increase of fog when the concentration advances, particularly in developers of high sulfite concentration. This paradoxical property of preventing and promoting dichroic fog are merely two effects depending upon concentration.

Neutral Salts.

We have already noted that gelatin will swell much less in a solution of sodium carbonate than in pure water, but this fact cannot be used to great advantage because the carbonate is an active part of the developer. However, there are other salts which exert a similar inhibition upon the swelling of the gelatin, yet which do not take any particularly active part in the development reactions. These salts include **nitrates, phosphates, oxalates, sulfates**, and so forth. Because of its cheapness and availability, sodium sulfate is usually chosen. It is not truly neutral because when it is added in sufficient quantity to prevent dangerous swelling at high temperatures, it also retards development. But, as development would proceed much too rapidly at the high temperature, the combined action of retardation and non-swelling has made this the favored ingredient of "all-temperature" developers.

Hypo.

Hypo is sometimes added to developers with the idea that it gives more brilliance to the negative. Actually it retards development, decreases density, and increases the tendency to fog. Under some conditions it is possible to add sufficient hypo to the developer so that development and fixing will take place together, but this is a process not widely used.

Viscous Solutions.

Many advocates of the use of syrups have from time to time told of the wonders achieved by their own particular syrup. Glycerin, glucose, ordinary sugar, and similar heavy liquids have been added to developers. The idea is to retard the rate of diffusion of solution into the emulsion. The theory is that development will thus be limited to the surface of the emulsion, and that contrast and grain thereby will be lessened. Actual experiment, however, has shown that beyond increasing the time of development somewhat the action is largely negligible.

Summary.

The photographic developer is a complex solution whose function it is to reduce to metallic silver those grains of silver bromide which have been exposed to light, and to leave unaltered those grains which have not been exposed.

This ideal is not fully realized, but it is approximated through the use of the complex solution containing a chemical reducer which does the actual developing, sometimes called the **developing agent**; a **preservative** to prevent interaction between the reducer and the oxygen of the air; an **accelerator** to facilitate the chemical action between reducer and exposed grains; a **restrainer** to retard development of unexposed grains, and minor additional substances added to the developer for various real or imaginary reasons.

The developer will function in a variety of concentrations and at various temperatures. Solutions made with varying proportions of multiple reducers will function in a way which partakes of the characteristics of both or all reducers.

Time is a function of temperature, and to a lesser degree it may be used as a contrast control, although contrast is more readily controlled through variation of concentration.

The action of the various ingredients is not limited to their basic function. The additional effects may, as in the case of the alkali, be advantageous; or, as in the case of bromide, a handicap. The specific action of some ingredients, such as sulfite, may change considerably with concentration, and, as in the case of iodide, increasing concentration may produce an effect directly opposed to that of the weaker concentration.

The type of developer is chosen to suit the work to be done. It is made up with due attention to the effect of proportions of the various ingredients. Care is taken to insure the freshness and purity of the chemicals used; this care is extended to the water which may have natural alkali or other soluble salts which will exert some effect upon the development. The solution is used in a suitable container or tray. The film is immersed in the solution and care is taken to insure the absence of bubbles or foreign matter. The solution is allowed to act for a definite period of time at a definite temperature, and agitation either at intervals or throughout development insures uniform developer action.

Post-Development Treatment.

The developed image is the end for which the photographer works, but his task is not completed when development is finished. Although we have made use only of certain selected sensitive grains, the unused ones are still in the emulsion and **still sensitive.**

There is one point which often confuses the beginner about this stage of the processing. If the film is removed from the developer and rinsed well, it will not be injured by a slight exposure to light. True, the remainder of the sensitive emulsion will be **exposed,** but it will not be **developed.** Therefore, unless the film be returned to the developer, a slight exposure to light after development and before fixing will not injure the negative.

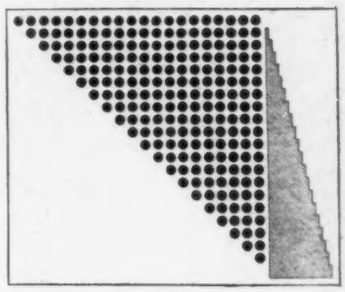


Fig. 13. After development the residual sensitive silver halide must be removed to prevent its blackening. This is done in a fixing bath as described.

To make the negative usable it is necessary to remove from the emulsion all of this unused (undeveloped) silver bromide (Fig. 13). After that is done, instead of an emulsion there will be a mixture of metallic silver grains supported in a film of gelatin. As neither silver nor gelatin are particularly susceptible to light action, the negative may be handled freely in any light.

Fixing Agents.

The choice of agents which will remove the unexposed bromide without affecting the deposited metallic silver is limited. In fact, the three agents most commonly recommended—**potassium cyanide, ammonium thiosulfate,** and **sodium thiosulfate**—all attack the deposited silver as well as the bromide. Potassium cyanide, besides being extremely poisonous, attacks the silver bromide so strongly that it has little fixing value except with iodide suspensions which are now practically never used. Ammonium thiosulfate removes the undeveloped bromide rapidly, but it is unstable, and the ammonia fumes make it unpleasant to use. This leaves the sodium thiosulfate, or **hypo,** universally used as the fixing agent.

Hypo is sometimes called "sodium hyposulfite," which is an unfortunate error inasmuch as sodium hyposulfite is an entirely different substance having the formula $Na_2S_2O_4 \cdot 2H_2O$, whereas sodium thiosulfate, the photographer's "hypo," has the formula $Na_2S_2O_3 \cdot 5H_2O$.

The Fixing Bath.

Hypo in alkaline solution has very little effect upon metallic silver, but unfortunately the use of the alkaline bath is not practical. It will be recalled that one of the most important constituents of the developing bath is the alkali, and obviously the developing bath is alkaline. When the negative is removed from the developer it is filled with the alkaline solution, and even when rinsed there is a considerable alkaline concentration carried over. Not only is there a tendency toward excessive swelling in an alkaline fixing bath, but there is a considerable danger of dichroic fog and other silver stains occurring. Finally, in the alkaline bath the imbedded developer will continue to develop until the bromide is removed, and this almost always results in uneven development.

The obvious remedy is to make the fixing bath neutral or acid. The neutral bath attacks silver very

slowly, but in practice the neutral bath would rapidly become alkaline by the introduction of developer. The practical solution is to make the fixing bath definitely acid. It is true that hypo in acid solution attacks silver and other metals rather vigorously. Under some conditions the continued action of an acid hypo bath for as little as forty-eight hours is sufficient to bleach the image completely. This is hardly a serious disadvantage, however, as there is no need to soak a negative or print in hypo for two days.

Of course there is the partial remedy of using an acid stop bath between the developer and the hypo. But **as ordinarily made and used,** the stop bath is a snare and a delusion. If the bath is renewed often enough to keep it acid, so much the better, but the usual procedure is to take a negative or print from the developer, push it into the stop bath, pick it up, drain a second, and so into the hypo! Well it does remove the surface developer and to that extent prevents many stains which would otherwise occur; but to use the stop correctly the negative should remain in it at the very least a full minute. This means sixty seconds by the clock, a period of time which is usually estimated mentally as between ten and fifteen seconds. The miniature negative technique of five full minutes in a chrome alum-bisulfite bath is the kind of stop bath which really works.

But that is pure digression. Having determined to make use of the acid hypo bath, the next step is to acidify it. The direct addition of most acids to a solution of hypo results in the precipitation of sulfur. According to Neblette the reaction is a reversible one.

$$H_2S_2O_3 \rightleftarrows H_2SO_3 + S$$

According to the chemical equation the free acid of sodium thiosulfate (thiosulfuric acid) is broken down into sulfurous acid and sulfur, and these in turn recombined to form the thiosulfuric acid. In the bath what we actually have is the decomposition of hypo into **sulfite** and **sulfur,** and back to hypo again. If there is an excess of sulfite added to the solution this reversible reaction is blocked, and the hypo remains stable. Moreover, the sulfite plays the same role it does in the developer, namely, preventing discoloration by oxidation products, and thereby acting as an efficient stain preventive.

Inasmuch as alkaline developer is constantly being carried into the fixing bath, the need for a considerable amount of acid is obvious. On the contrary, too strong an acid will precipitate the sulfur in spite of the sulfite; so it is necessary to resort to acids which are inherently weak yet which have a full neutralizing power. One of the best is **acetic acid,** although E. J. Wall once offered a **citric acid** bath of considerable merit. It is possible to acidify the hypo by the addition of **sodium bisulfite** ($NaHSO_3$). The addition of this chemical is closely analogous to the addition of sulfite and sulfurous acid; it takes care both of the preservative action and the acidification of the solution. While such a bath is widely used, it is not as efficient as that using acetic acid and sulfite.

The Hardener.

So far we have determined the advantage of a hypo bath which is sufficiently acid to prevent undue swelling of gelatin, which will neutralize the alkalinity of the developer, which will prevent staining, and which will resist decomposition. There is but one other factor to consider, and this is the fragility of the gelatin after passing through the preceding solutions. It is generally recognized that some kind of tanning or hardening is advisable. This may be done in an intermediate bath between developer and fixer, but more commonly the gelatin is hardened while fixing by the addition of **alum** to the hypo solution.

Alum, either the white **potassium alum** (potassium aluminum sulfate), $Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$, or **potassium chrome alum** (potassium chromium sulfate), $Cr_2(SO_4)3 \cdot K_2SO_4 \cdot 24H_2O$, renders the gelatin tough and leathery, the action proceeding best in alkaline solution. But as this would work havoc with the negative, the alum is added and does its work satisfactorily in the acid fixing bath.

When hypo and ordinary white alum are mixed in solution and boiled, both are completely decomposed. Sulfur and aluminum are precipitated, sulfur dioxide is liberated, and sodium sulfate is formed in solution. When the reaction takes place at ordinary temperature, aluminum thiosulfate is formed, and breaks down into aluminum sulfate and hydrogen sulfide. This reacts with the excess of hypo to form sodium bisulfite and sodium hydrosulfide, with the precipitation of free sulfur. Aluminum sulfate is regenerated, and the reactions continue. This complex cycle is inhibited or entirely prevented by the addition to the hypo of sodium sulfite or bisulfite, or the acetate or citrate of sodium. If the alum-hypo solution becomes alkaline, as it may if too much developer is carried over into it, aluminum sulfite will be deposited **within** the gelatin, and this is almost impossible to remove. This precipitate is white, and in the minute amounts deposited would form a grayish veil over the image, and a particularly objectionable effect in a print. For these reasons the hypo solution is kept acid.

There is some question as to the advisability of using a combined hardening-fixing bath. Many skilled workers claim that there is a loss of quality when such a fixing bath is used. It is beyond question that if negatives are left to soak in the hypo for an hour or so there will be a loss of delicate tones. On the contrary, if the fixing bath is used correctly, there is no reason why the alum bath should injure the negative. It is true, of course, that when the chrome alum-bisulfite bath is used between the developer and fixer, there is no reason for using the alum-fixer. But even in that case the use of the **acid** fixing bath is advisable. As we are not concerned here with the problems of printing we shall not go into the subject of using a plain hypo bath for fixing prints.

Fixing the Negative.

Having determined that the acid fixing bath (with or without alum) is preferable, what can we expect this bath to do? One thing of importance is to know the conditions under which the bath will work best. We will ignore the cyanide and ammonium salt, limiting ourselves to the use of hypo. One would think that the more concentrated and the warmer the solution the more rapid would be the fixing effect, but this is not true (Fig. 14). A forty per cent solution of hypo is the most efficient strength for silver bromide removal. As the developer is alkaline and the hypo is acid, too strong a solution of hypo sets up a reaction which forms gas and produces blisters beneath the emulsion. Moreover, there is a penetration differential which upon washing causes the hypo to leave the gelatin more rapidly than the water can enter it, and this, too, promotes blisters and frilling. For these reasons it has been found advisable to use the hypo in a

strength of twenty-five per cent and less (Fig. 15.)

Ordinarily the working solution is made by dissolving four ounces of the hypo in sixteen ounces of water. This solution acts readily, but if the hypo is reduced to fifteen per cent and ammonium chloride equal to one quarter the weight of the hypo is added, the action is speeded up considerably. However, this is of little real value. What is of more value is the way in which hypo is used and the way in which it should **not** be used. The usual method of fixing is to continue to use hypo until it is exhausted and fails to clear the film. As hypo is extremely cheap, this is a grave mistake which many amateurs make.

Hypo removes undeveloped silver bromide in an inverse geometrical ratio. If half of the free bromide is removed in the first minute, half of the remainder will be removed the second minute, one-half the remainder in the third minute, and so on. Theoretically it is impossible to remove all the bromide. In more practical aspects we have two schools of thought on the subject.

According to Clerc, the disappearance of the milky deposit of bromide indicates that 95 per cent of the silver bromide has been removed. Assuming that this takes five minutes, the end of another five minutes would remove 95 per cent of the remaining 5 per cent, or would leave a residue amounting to one-quarter per cent which is negligible. This is the support for the conventional advice to leave the negative in the hypo just twice as long as is required for complete clearing of the milky deposit.

On the contrary, Neblette tells us (and I hold to his thought rather than to Clerc's argument) that when a fresh hypo bath is used, the silver salts have to all practical intent been removed when the milky appearance disappears completely. However, when the hypo has been used and contains more than two per cent of silver salts, the residual salts are not removed when the film is cleared, nor will they be removed by prolonged soaking in the hypo. The only way to remove them is to put the films in a fresh hypo bath.

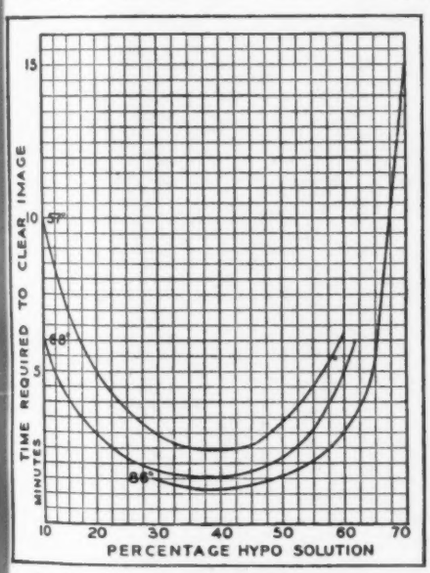


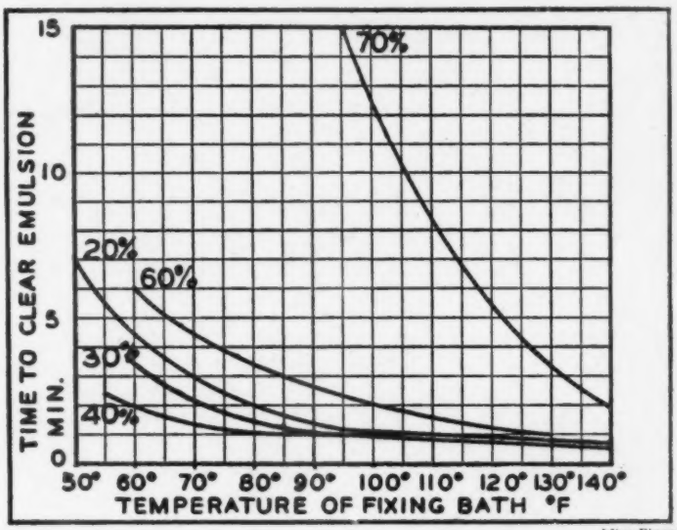
Fig. 14. Showing effect of temperature in fixing with hypo of various strengths, based on time of clearing (after Piper).

For the best fixing, therefore, it is advisable (a) to use a freshly mixed fixing bath and discard it when it has been used, or (b), use a fixing bath which has been used before and fix in this followed by final fixing in a fresh bath which then becomes the used bath for the next fixing. This may appear troublesome and extravagant, but compare the cost of hypo with the cost of films and you will see that fresh hypo is the best insurance of permanence you can get. Fresh hypo does not necessarily mean freshly mixed, because a quantity of strong stock can be mixed and diluted for use; but in that case it is better to have the hardener mixed separately and mix the two when diluting for use.

bath.

Life of Fixing Bath.

However, it is well to know what service we may expect from hypo when it is pushed to its limit. According to the Eastman Research Laboratories, one gallon of the acid-hardening hypo will fix approximately 9000 square inches of film surface. This represents about seventy-five per cent of the maximum



After Piper

Fig. 15. Fixing action of hypo based on percentage in solution.

fixing power of the same amount of straight hypo solution. As most amateurs use smaller quantities than this, let us break down the quantity. As 9000 is the maximum, we shall assume 7500 square inches as a safe working figure. Dividing this by four we get 1875 square inches of film which can be fixed safely in one quart of hypo. The average 35 mm film contains ninety square inches, or about twenty films to the quart. The average 120-size roll contains about 72 square inches, so even more could be fixed in the quart of solution. However, these figures are rarely approached in practice, the hypo being exhausted by developer carryover or other decomposition before this optimum quantity is reached. The average 3¼x4¼ film has an area of 13.8125 square inches or 165.75 square inches per dozen. This means that a quart of hypo should fix more than ten dozen such films, a feat which few amateurs would have the temerity to attempt. If the average amateur uses his hypo for half the above quantities he will be getting far more than his money's worth. In fact, I have long contended that any negative worth making is worth the quantity of **fresh** hypo necessary to fix it properly.

But why all the bother about fixing? When the whitish bromide is gone the film is fixed isn't it? Not at all. When silver bromide is placed in contact with hypo there is an instantaneous formation of silver thiosulfate which changes at once to complex sodium and silver thiosulfates. According to Abney[5] and later presented by Neblette, the reactions involved are:

$$2\ AgBr + NaS_2O_3 = 2\ NaBr + Ag_2S_2O_3$$ (Silver thiosulfate).

$$Ag_2S_2O_3 + Na_2S_2O_3 = Ag_2S_2O_3{\cdot}Na_2S_2O_3$$ (Silver monosodium thiosulfate).

$$Ag_2S_2O_3{\cdot}Na_2S_2O_3 + Na_2S_2O_3 = Ag_2S_2O_3{\cdot}2Na_2S_2O_3$$ (Silver disodium thiosulfate).

Silver thiosulfate is insoluble in water, but it is soluble

[5] "A Treatise on Photography," by Capt W. de Wiveleslie Abney, 8th edition, 1893.

in a solution of sodium thiosulfate. Consequently, it is changed into the second form, the monosodium salt. This, too, is insoluble in water but soluble in hypo, so it is again changed into the third or disodium salt. This salt being soluble in water is removed by washing.

It is obvious that the reaction must be complete to the third step before the products can be removed by washing. These salts are formed in microscopic form, and it is easy to understand that they, being in solution, make no visible difference in the appearance of the film. Moreover, the undeveloped silver bromide is also in microscopic crystals, and thus the film will become apparently cleared before the final grains are dissolved. It is estimated that when the film appears clear, about five per cent of the silver halide is still undissolved, and that there are still certain of the complex salts in the first two forms. To complete the fixing, it is necessary to convert these complex salts and to remove the bulk of the remaining five per cent of silver halide.

Now if the halide conversion does take place in strict geometrical diminution, the theory of Clerc would apparently be upheld, but if there is a progressive increase in the proportionate removal—that is, if the relative rate is increased through the absolute rate of removal being more nearly approximated—then the statement of Neblette seems to be logical. In any event, the action of fresh hypo is such that within limits of practical application the Neblette statement can be used as a guide in controlling the fixing step. Therefore, in the general-purpose fixing bath we have:

Sodium thiosulfate. This is the true fixing agent, in this respect being analogous to the reducer in a developer. Its function is to remove the silver halides (bromide, chloride, etc.). It might be added that the removal is not strictly in solution, as a solution of sugar in water, but rather a chemical reaction in which elements recombine to form new products.

Acid, usually acetic. Clearing agent. Increases the penetration of the hypo, and thereby speeds up the process of fixing. It reduces possibility of stain and acts as a regulator for the hardener. Incidentally, it neutralizes any alkaline developer carried over from the first bath.

Sodium sulfite. Acts as a preservative through stopping oxidation. Prevents decomposition of the sodium thiosulfate.

Alum. Hardens the gelatin and tends to prevent frilling, blisters, and reticulation.

Washing and Drying.

When the negative is fixed the gelatin, in addition to the metallic silver of the image, is impregnated with the soluble silver disodium thiosulfate. If fixing has not been complete, there will also be present some of the silver thiosulfate and the monosodium thiosulfate, both of which are insoluble in water. If these salts are left in the gelatin they will in time produce silver sulfide, and the print will turn yellowish—in other words, it will "fade."

Referring to the statement of Neblette, no matter how prolonged the fixing may be, if the hypo contains in excess of two per cent of silver salts there will not be a complete reaction, and no amount of washing can remove the two insoluble forms. Therefore, it is evident that the most important factor in the removal of the hypo and other salts is not the washing itself, but the matter of thorough fixing.

When the negative has been thoroughly fixed, washing is a comparatively simple matter. Under such conditions the materials to be removed are hypo and the soluble disodium salt. Both are removed easily. As a matter of fact it is an error to speak of "removing" these salts because they literally jump out of the gelatin. Because of osmotic pressure, the salts are actually forced out of the gelatin until the wash water has taken up a sufficient quantity to be of the same salt concentration as the gelatin. When the film is first removed from normal hypo and placed in pure water, this pressure may reach as high as five pounds per square inch. However, when equilibrium has been established, no further removal of hypo is possible until the water is replaced with a fresh supply. Then equilibrium is again established, and so on. It is interesting to note certain facts governing the rate of hypo removal. The same time is required in each case to reach equilibrium, although in each period of time only **half** the preceding amount of hypo is removed. This is in accord with the rate of fixing, but there are so many factors affecting actual washing that this is of greater theoretical than practical interest.

The equilibrium period is usually stated to be about five minutes, which is about right, but as ninety-nine per cent of the removal will take place in about two minutes, it is more practical to accept the two minute base. Assuming that a 5x7" film has been removed from the fixing bath, it will carry with it, in superficial and absorbed hypo, a volume of approximately five cubic centimeters. Assuming furthermore that the fixing bath was a 20 per cent hypo solution, this means the plate carries with it one gram of hypo. If it is placed in a container with 95 cc of water, the total liquid volume will be 100 cc. Equilibrium will be reached at the concentration of one per cent (1 gram hypo in 100 cc water). This is one-twentieth of the original. Repeating the same washing, the concentrations after each washing will be: 0.05, 0.0025, 0.000125, 0.000,006. According to Hickman and Spencer a residual hypo concentration of 0.0036 gram in a 5x7 film will have no bad effects upon the silver image. If we assume that the gelatin of this plate will carry 3 cc of solution, and if we increase the safety margin tenfold, we can assume washing to be complete when the concentration has reached 0.00036 x 100/3. This is roughly 0.01 per cent. Referring to the values given above, it will be seen that the third stage of equilibrium will reduce the concentration to one-fourth this required minimum. In other words, after the third equilibrium the concentration will be only 1/40 part of that which has been stated to be safe!

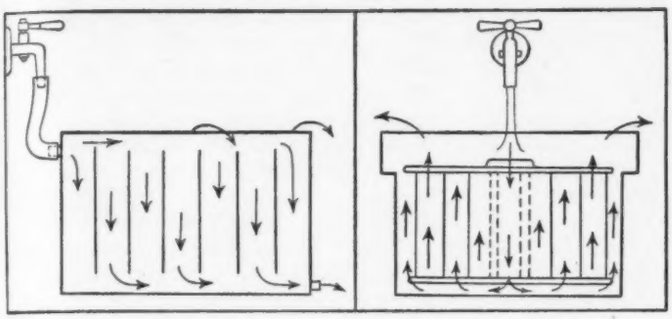
If we are content with the 99 per cent equilibrium of the two-minute base period, the third such equilibrium will still provide a wide margin of safety, thus making it possible, with proper care, to wash negatives thoroughly in six minutes. (The hypo absorption by the paper base introduces an altogether different factor in the case of prints.)

It must be noted that such a period of washing will serve only when every precaution is given to correct conditions. The film must have free access to the water. For example, if the film is laid face up at the bottom of a tray or tank, the water saturated with the dissolved salts will blanket the film while the water at the top of the container remains practically salt-free. A vertical film will have the top edge completely washed before the bottom. In vertical tanks there should be a considerable free space below the bottom edge of the film, and in all cases there must be sufficient agitation to make sure that complete equilibrium has been established.

It will also be noticed that the above statement re-

fers to the washing of a **single** plate in the amount of water indicated, and so placed that the salt-charged water may easily be replaced by fresh water. In the practical aspect of washing a number of films, or a long roll, the conditions may be approximated only by insuring a constantly replenished supply of fresh water.

Hypo-charged water is heavier than pure water. If the films are placed in a tank and water run into the



Methods of washing negatives in cut film tank (left) and rollfilm tank (right). Note how hypo-laden water is carried away.

top, the fresh water simply skids off the surface and down the drain while the hypo laden water in the bottom of the tank is little affected.

In practical washing of films (and plates), several methods of efficient washing may be used:

1. If the tank has a drain at the bottom, this drain may be partly opened and water run into the top of the tank faster than it runs out of the bottom. This keeps the tank full, yet it constantly drains off the heavy hypo solution at the bottom.

2. In a tank without bottom drain, a hose with a small nozzle (which may be made by drawing out a piece of glass tubing to small diameter) is inserted in the tank in such a way that the force of the stream carries the fresh water to the bottom of the tank, forcing the hypo solution out at the top.

3. In a period of twenty minutes washing, the tank may be emptied completely every three or four minutes, thus combining the running water and change bath systems.

4. The water may be added and allowed to stand stagnant, the tank being emptied and refilled every three minutes for twelve changes.

5. Using the ordinary rollfilm tank, it is advantageous to combine methods 2 and 3. The tank is emptied three times during washing and so eliminates any small portion, of the hypo which might get caught in some eddy current and so escape being flushed out.

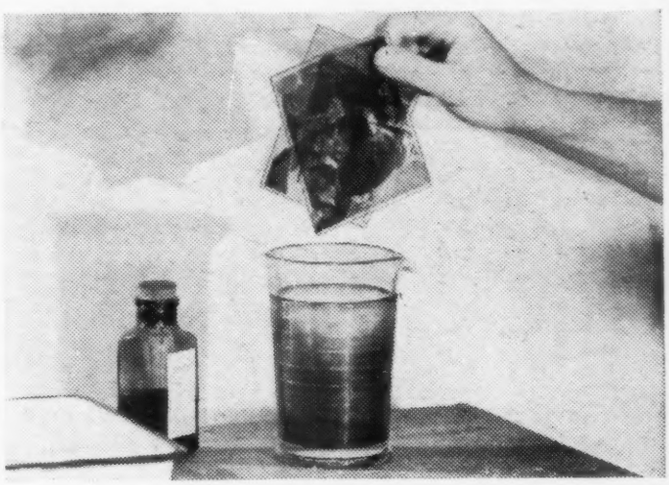
Hypo Tests.

The degree of development is apparent to the eye and may further be checked by instruments, but the efficiency of the fixing and washing operations is not so easily checked. There are some rule-of-thumb methods for checking hypo. If the solution gets gray and milky it should be discarded. If it froths badly when beaten by shaking the fingers in it, it is to be discarded. A rough approximation may be arrived at by calculating the area of film surface fixed, but to do this with any accuracy it is necessary to know the bromide concentration in the various films which have been fixed as well as the quantity of solution carried out of the bath by each film. It is said that when the fixing bath requires double the original time to remove the visible opalescence it is exhausted. This is entirely too true to be of value, because when the bath requires twice its original time to act it is far too weak for any satisfactory use.

A satisfactory test is the drop test. A drop of the hypo solution is placed on filter (blotting) paper and exposed to direct sunlight and kept moist. If it turns brown the bath should be replaced. For a more scientific method, a small measured quantity of hypo is taken as a sample and to this is added one tenth its volume of a five per cent solution of potassium iodide. If a permanent yellow precipitate is thrown down the bath should be discarded.

As far as washing is concerned, there are several reliable tests which will indicate the removal of all dangerous quantities of hypo. A simple test, yet one which is accurate if properly used, is the conductivity test. This consists in measuring the current which will flow across a fixed volume of the solution when placed in an electrical circuit. The simplest outfit consists of a battery, a sensitive meter such as a milliammeter, and two leads which terminate in plates of about one square centimeter area spaced by about one to two millimeters. The addition of a rheostat will permit setting to any desired reference point. The reference point is determined by taking a reading of the water used for washing. This will take care of any slight natural mineral salt content. The meter is calibrated by making meter readings of a series of hypo solutions in concentrations of 1.0, 0.1, 0.01, and 0.001 per cent. The water from the usual source should be used, and when there is an abnormally heavy mineral content, this masks the hypo and renders the method useless except when a test control is run with distilled water. It might be added that the nature of the natural minerals should be determined, as they may have some undesirable effect upon the permanence of the image.

Of the chemical tests, the starch-iodine and potassium permanganate are the most widely known. A



Method of testing drippings from washed film to detect remaining traces of hypo, using a permanganate solution (page 146).

starch solution is made and just sufficient iodine added to give it a pale but distinctly blue color. The permanganate solution is made to such a strength that the color is a pale magenta-rose and the solution perfectly transparent. In both cases the more delicate the color the more delicate will be the test. Just sufficient strength is used to impart a distinct color. If water containing even a trace of hypo is added to either of these test solutions the color will be eliminated. The persistence of the color when water is dripped from the washed negative into the test solution is evidence that the film is washed sufficiently.

It is obvious that these tests indicate the absence of hypo, but the presence of the complex silver thiosulfates does not give a positive reaction, so while washing may be complete, there is no indication that fixing has also been completed.

A positive test may be made if a control film (which need be only a portion of a full sheet) is carried through with the films being processed. After washing, this control film is placed in a solution of **sodium sulfide.** The appearance of any brown coloration indicates the presence of the complex silver salts, and the films should be returned to **fresh** hypo for further fixing.

In all these tests it is advisable to run control checks, because the water supply often contains materials which will affect the test. For example, instead of the rough-and-ready permanganate test being made with a straight water solution, it may be done this way: A stock solution is made up according to the formula given here.

Potassium permanganate	**5 grains**
Sodium carbonate	**5 grains**
Water	**10 ounces**

This solution has an intense violet color. To use it, take four ounces of the water which is being used for washing (that is, the normal water supply). In another beaker collect an equal quantity of drippings from the films. Set the two beakers side by side and to each add one drop of the stock solution. If the pale rose color persists as long in the drippings as it does in the plain water, washing is complete. It may be that there are certain organic materials in the original water which will decolorize the permanganate. If this is true, add additional permanganate to the control until the faint rose color persists, then add an equal amount of permanganate to the drippings, and note the duration of the color. The fading of the color in the drippings in any time appreciably shorter than in the control indicates the presence of a dangerous amount of hypo.

Hypo Eliminators.

The washing process is sometimes hastened by the use of chemicals which react with the hypo. Such methods can only do two things—change the hypo into some other substance whose presence will not be revealed by hypo tests and which is (presumably) less harmful than the hypo, or convert the hypo into something more easily removed from the gelatin. We have already seen that the hypo is forced from the gelatin under considerable pressure, and a more soluble product would simply mean something forced out under still greater pressure, bringing with it still greater danger of blisters. If the change is one which produces an "inert" chemical which remains in the gelatin, the value of the process must always be open to grave question.

In this connection about the best presentation of the problem is that of Clerc who has said, "The idea of attempting to destroy hypo instead of eliminating it is almost as old as photography. This idea is unfortunately opposed to common sense and to a sufficiently large number of experimental facts. To begin with, a chemical action never 'destroys'; it can only transform, and those who have commended such practice have usually not tried to discover whether the products of this transformation are any less liable to damage the image than is the hypo from which they have been obtained. On the other hand, the substance which actively alters images is not so much the hypo as the insoluble complex thiosulfate of sodium and silver. It is therefore necessary to find out the form in which this salt of silver exists after the action of the eliminator." To this we should add the pointed comment of Neblette, "Plenty of water properly applied is still the secret of thorough hypo elimination."

Regardless of the method used for hypo elimination, the final result is to be regarded with suspicion; the process is more involved and takes almost, if not quite, as much time as washing, and on the whole represents additional effort with no concrete return. One of the great attractions has been the advertised fact that films may be washed in ten or twelve minutes. These claims may or may not be true. In my own collection there are thousands of films, many of which date back to 1919 and today are apparently in the same condition as when they were first dried. My standard method calls for a maximum of fifteen minutes washing with a routine time of ten minutes, **but under a forcible stream of water which will effectually prevent the trapping of hypo solution by eddy currents.**

Drying.

Many films are coated on both sides with gelatin, the 35 mm miniature film being an exception. Such films have both faces loaded with water when removed from the washing bath. The surface water is removed by wiping with a squeezed out chamois (which is kept under water, in a closed jar when not in use), or with a viscose sponge. Viscose sponges which are squeezed to hasten their wetting, or which are folded or twisted in wringing out soon deposit minute particles of viscose upon the film which are almost impossible to remove. One of the best means of removing superficial water from negatives is to blot them between sheets of special lintless, insoluble paper of the type used for making tea balls. This paper is available from photographic supply dealers.

After blotting, the negative contains about one or two grains of water per square inch of surface, both coatings to be considered, so that a 4x5 negative of twenty square inches has forty square inches of coating containing from forty to eighty grains of water; and considerably more if the temperature of the wash was appreciably above seventy degrees F. This water is removed by evaporation, and the rate of evaporation depends upon the humidity of the air. In very humid air the film dries slowly, while in dry air, it dries more rapidly. The dried film should contain ten per cent or slightly more water, as thoroughly dry gelatin is brittle and curling.

Relatively dry air—that is, of less than sixty per cent humidity—tends to dry the surface gelatin, "sealing over" the lower strata which remain moist. Upon storing the film, the moisture content resumes equilibrium and the surface becomes sufficiently moist in some cases to adhere to any other film with which it is in contact. Drying should proceed at a uniform rate. There has been some discrepancy in reported results of differences in drying rate. Experimental data shows that sometimes the slower drying areas are lighter and sometimes darker. The data is insufficient to indicate the exact causative conditions accurately. Drying may be hastened by forced drafts of warm air, but the temperature should not be excessive, and care must be taken that the forced draft does not project dust particles against the emulsion.

Water drops usually cause a secondary swelling at the edge of the drop with a consequent depression in the center of the area which, after drying, leaves a dark ring surrounding a light center. Drops on the back

of a film will retain moisture on the face because the evaporation of the drop on the back has cooled the base sufficiently to retard evaporation from the face.

Films which have been hardened in a fresh alum hardening bath may be dried in the sun if there is no shadow which would cause uneven drying. Negatives in which the slightest deformation must be prevented, such as color separation negatives, spectroscopic and astronomical negatives, should always be dried under controlled, constant conditions.

Films which are to be subjected to a considerable degree of enlargement should be carefully dried in dust-free, warm air. The best means of accomplishing this is to make use of the film driers which are available. One of the most favored forms is a long metal tube of sufficient diameter and length to permit the film to be hung in it. This tube is inserted in the air pump case. This pump takes in air through a dust-proof filter, warms it, and forces it out through the tube. The air draft prevents dust falling into the tube, while the filters insure uniform results and freedom from dust.

When speed is demanded there are certain methods available which, however, are not to be recommended if you want to produce perfect, permanent negatives.

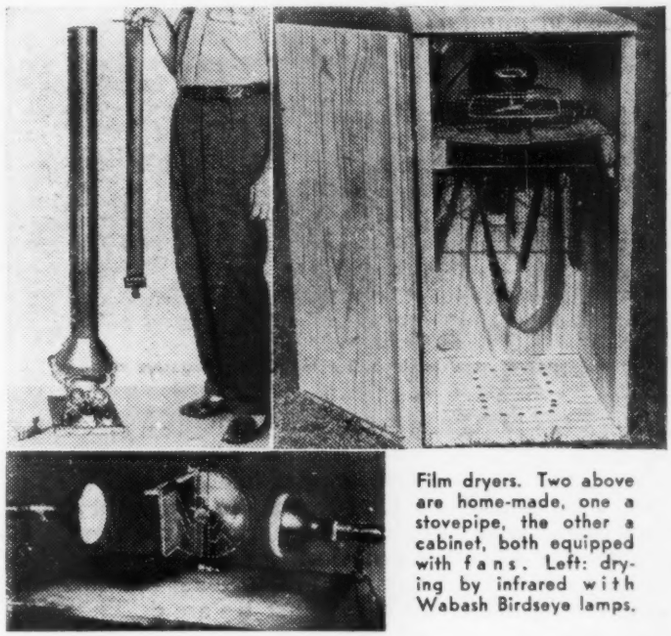
A rapid drying method is the alcohol wash. The wet films are soaked in alcohol for a minte or two, to permit the alcohol to mix with the water. The alcohol evaporates rapidly, thus drying the film in less than usual time. When pure ethyl alcohol can be used in a concentration of at least seventy per cent the method is quite satisfactory, but it must be remembered that this hastens only the **drying** and is not a substitute for washing. Denatured and rubbing alcohols deposit their added ingredients and streak the negative.

Another rapid drying method is the immersion of the wet negative in a strong solution of sodium carbonate and drying it without further washing. After drying, it is again washed to remove the carbonate. This, too, is a usable emergency method but should not be used on valuable negatives.

Various salts may be used for the preceding method, including aluminum sulfate and sodium sulfate, but the carbonates are the most satisfactory, either the sodium or the potassium salt. This method, which after all is really only a temporary drying, may be tried as follows: The negative is taken from the wash and immersed in a saturated solution of potassium (or sodium) carbonate for about five minutes. It is then removed, wiped quickly with blotting paper, and then immediately wiped dry with a cloth. The surface appears hard and glossy and may be put immediately to use for printing. But in any event the negative must at some later time (and a time not too long deferred) be washed again to remove the carbonate. Ordinarily the negative may be left in the intermediate stage for some weeks, say two or three, but when this method is used, as it often is, to dry **partially fixed** negatives quickly, the thorough washing should not be delayed more than two or three days.

The Finished Negative.

When the negative has been dried it is ready for use or for storage. At this point we must make a distinction between the photographic and pictorial images. Both are the same image, it is true, but in the photographic image we are concerned with the physical characteristics of the silver deposit and in the pictorial image we are concerned with the pleasing effect of the shapes of the image areas. To differentiate fully we shall, unless otherwise stated, assume that we are working with a negative composed of a series of stripes which range from transparent film through various shades of gray to an opacity too heavy to be used for printing. In short we shall assume the negative to be



Film dryers. Two above are home-made, one a stovepipe, the other a cabinet, both equipped with fans. Left: drying by infrared with Wabash Birdseye lamps.

the twenty-one step negative which was used to describe the basic nature of the image. Because any photographic negative is nothing more than a series of different depths of gray tone separated by more or less distinct boundaries, such a negative will permit all our attention to be focused upon the factors involved and prevent distraction by purely pictorial elements.

Density Defined.

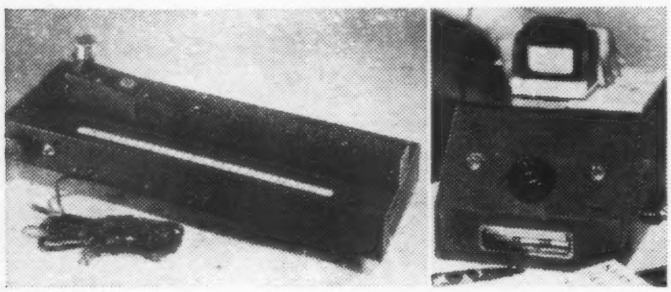
Light cannot pass through any transparent material, not even thin glass, without some loss. When the material is the combined celluloid and gelatin of the negative, there must be a substantial loss, even when no gray tone intervenes. As we have seen, there is also a certain development of unexposed halide grains; so all in all our clearest stripe still has a definite absorbtion. In this discussion we shall consider only the light which passes through the film, as this is the condition encountered in printing.

Having means of measurement available, we can learn the intensity of the initial light and that of the transmitted light. The transmitted light can then be named in terms of the percentage of the original which it represents. For example, if half the light passes through the film, then fifty per cent is transmitted, and so on. This information is useful in many ways, but it is not entirely satisfactory for photographic purposes. Instead of speaking of the amount of light which passes through the negative, we refer to the character of the silver deposit in terms of **density.** One of the first things the amateur experimenter should learn is the true meaning of density.

If a 0.001 mm layer of silver will absorb half the light which falls upon it, a second similar layer will absorb half of the **remainder,** or twenty-five per cent; a similar layer will then absorb half the remainder or twelve and a half per cent, and so on. It will be seen from this that the successive absorption proceeds with **geometrical progression** and for that reason, if we are to have any standard of silver deposit it must be one

which is proportionate to the mass of the silver, within reasonable limits. This is the reason for using the density factor rather than the transmission.

If light of one hundred per cent intensity falls upon a negative and one fourth of it passes through, we have a **transparency** of twenty-five per cent or 0.25. As the



Two types of densitometers for measuring negative density.

reciprocal of 0.25 is 4, this same film has an **opacity** of 4. Likewise if another part of the film transmits one-eighth we have a transparency of 0.125, and an opacity of 8. In other words, **transparency is expressed as the fraction of light which passes through the film, and the opacity is the reciprocal of this fraction.** But this does not give us the desired proportional relationship. It is true that opacity means that we are dealing with the silver deposit, while transparency is based upon the **absence** of silver. Therefore there must be some relation between opacity and density. This is the case. **The density** (or as it is sometimes called, the absorption constant) **is the logarithm of the opacity taken to base 10.**

Thus any table of logarithms (logs) will show that the densities which correspond to our opacities of 4 and 8 will be 0.602 and 0.903 respectively. This brings to mind one point which it may be important to remember, namely, the unit density relationships. Density 1 transmits ten per cent of the incident light; density 2 transmits one per cent, density 3 transmits one tenth of one per cent, and so on. Thus density 3 transmits only one one-hundredth as much light as density 1.

Another logarithmic relationship which may prove puzzling at first is the fact that while density 2.0 transmits one per cent of the incident light, the density which transmits fifty per cent of the incident light is not density 1.00 at all but density 0.30.

The thickness of the deposit concerns us only in regard to the amount of light which it will intercept. Therefore, regardless of whether the emulsion may be thin or thick, rich in silver or poor, for our purposes we are concerned only with its density. It may be added, however, that in some special cases such as the pyro negative where the presence of stain of a nonactinic color alters the basic transmission of chemical light, the measured density is not a true reflection of printing value. However, such exceptions have no direct bearing upon our measurements and comparatively little in practical application to printing control.

Contrast and Scale.

When the negative is examined, the stripes across it will be seen to have a gradually deepening tone of gray until the last stripe is practically opaque. To understand the three representative conditions which characterize negatives we shall have to imagine three separate negatives:

First Negative. This negative is placed in an instrument which measures the transmitted light directly in terms of density. Such an instrument is known as a densitometer. (This and other factors now under discussion will be treated in more detail in Part Five of this series). We will assume that the darkest stripe of the negative has a density of 0.70 which means that it stops only about half the light which strikes it. In short, the deepest gray is definitely weak. The other stripes grow even weaker until the opposite extreme is represented by the clear gelatin and base.

In this case the greatest amount of light is one hundred per cent minus the loss in clear base, the least amount of light is fifty per cent, or a transmission ratio of less than one to two. Thus we see that the **difference** between the extremes is not great, and we learn that a density difference of somewhat less than 0.70 indicates a very slight difference.

To digress a moment, when we see a very tall man walking with a short one we are struck by the difference between them. If we see a young girl walking with her grandmother we again note a striking difference. If a building is brightly lighted on one side while an adjacent side is in shadow we see the difference a third time. But do we speak of the "difference?" Rarely. We may speak of the difference between two shades of pink, or that to be noticed in the appearance of a pair of twins, but when the difference is so marked and lies between two extremes we usually substitute the word **contrast.**

So in photography we rarely speak of the **difference** between two tones, but we commonly speak of the **contrast** between them. So familiar has the word become that we now use it even when the difference is slight. Hence we have such qualifications as high contrast, low contrast, normal contrast, medium contrast, and so forth. In these terms, therefore, our first negative has a low contrast.

Second Negative. In this negative we will assume that the darkest stripe transmits 0.8 of one per cent of the original light, and we will furthermore disregard the slight absorption of the clear base and assume that the transmission ratio is 125:1. In this case the opacity is the reciprocal of 0.08 or 125, and the density is approximately 2.10 (2.09691). This is about the greatest usable range of tone we can get in a negative, so we say that the contrast is "medium" or "normal," regardless of the fact that numerically the difference is 62.5 times as great as in the first negative.

Third Negative. In this negative we shall assume that the darkest stripe will pass only one one-thousandth part of the incident light while the opposite stripe is still clear. This means that the density range is from 0 to 3, while the opacity range is 1000:1 or eight times as great as the difference in the second negative. However, it is impossible to retain such a range of tone in printing, therefore the print will lose several tones by merging them into their neighboring ones, so we say that the negative has high contrast or excessive contrast.

It might be noted here that the term **soft** unless modified in some way refers to an image of low contrast. Softness of focus or definition is usually so designated. On the contrary, a negative of high contrast is usually called **hard.**

There is another designation which we should bear in mind. This is the reference to **scale.** If the contrast transparency ratio is low, such as 1:2, 1:5, or even 1:10, the negative is called a **short-scale** negative while a

great difference such as 1:1000 is designated by the term **long scale.** Because hard negatives are printed on soft papers and vice versa, there is some confusion regarding scale because a short-scale negative is printed on a short-scale paper, but a short scale paper is a hard paper, requiring only a few times its minimum exposure to produce the fullest black.

These terms refer to the actual silver deposit in the negative and have no imaginable relationship to the specific contrast, or **gamma,** although the word "gamma" is often used to denote the degree of contrast in any negative.

When an emulsion is given a series of known exposures and the negative is developed, the densities of the various deposits are measured. These densities are plotted against the base ten logs of the exposures. This graph results in an S-shaped curve known as the characteristic curve of the emulsion (see Fig. 11, page 137). It is valuable in determining the characteristics of some particular film, or the properties of some developing procedure. But too often you will hear a photographer speak of the various exposures on a single roll of film, all developed at one time, as having a "high gamma" or a "low gamma." Such a thing is an absurdity, as under such conditions the gamma would be constant for the entire roll.

We will discuss this at greater length in Part Five, but for the present be warned not to confuse the contrast scale of a negative with gamma. The original contrast of the subject, the lighting used, and the colors of the subject may well affect the contrast scale, but such things will not affect the gamma. Having accepted the fundamental importance of the density of the silver deposit, there are other factors which must receive some attention.

Graininess.

Close examination of an enlargement from a negative will show that large areas of monotone have a finely granular appearance. This is the graininess of the negative. It has been so often repeated that graininess is the projected image of the silver grains in the emulsion that the explanation is accepted as fact. Unfortunately it is one of those facts which have no foundation whatsoever.

When the negative is developed there are certain silver grains which will stick together, just as grains of sand will cling together when moistened. But we must also remember that when two grains touch, both are developed even if only one was exposed. Thus if the gelatin it attacked we often have long crooked chains of grains developed when only one of them was really exposed. The physical appearance of such a condition might be likened to several dozen strings of beads dropped carelessly upon a table. Even the beads of the string are not made up of single grains, but of several grains clumped together. So we can see that the microscopic grains through third degree bunching together will become large enough to produce an image even at moderate enlargement. Even so, these bunches and strings are not the true origin of the graininess in the print.

Figure 16 shows a greatly magnified presentation of grain-chain formation in the negative. The upper drawing represents a view looking through an emulsion, while the lower drawing represents a cross-section of the emulsion. At the left, above, is a complex chain, which upon examination from the side proves to be made up of six short chains and two isolated grains. At the lower right, above, is shown a complex structure formed by many single chains scattered at various depths in the emulsion, as revealed in the cross-section.

Another illustration, Fig. 17, shows an isolated grain pattern. The upper drawing shows how much more nearly the dot pattern approaches a uniform tone

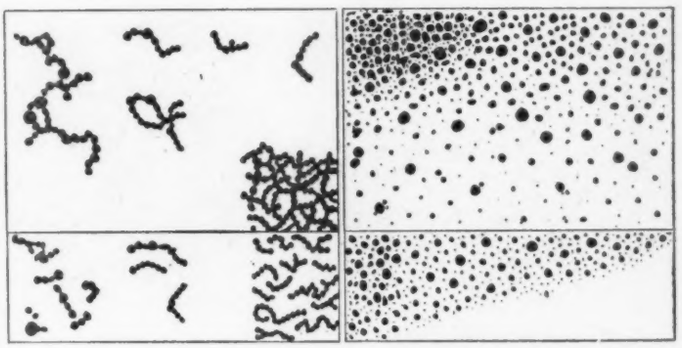


Fig. 16. Grain chain formation. Top, a view looking through the emulsion; below, a cross-section.

Fig. 17. Isolated grain pattern; decreasing depth of grain accompanies decreasing density.

than does the chain network. At the upper left there is an area of great density grading toward the right and toward the bottom. The lower drawing shows in cross-section how the decreasing depth of grain mass accompanies decreasing density.

Remember that a black spot in the print must always come from a light spot in the negative. Therefore the origin of the grain images must be **spaces between silver grains in the negative.** Just imagine the way in which light falls through the leaves of a vine-covered arbor and you will get a fair picture of the condition which is responsible for the graininess.

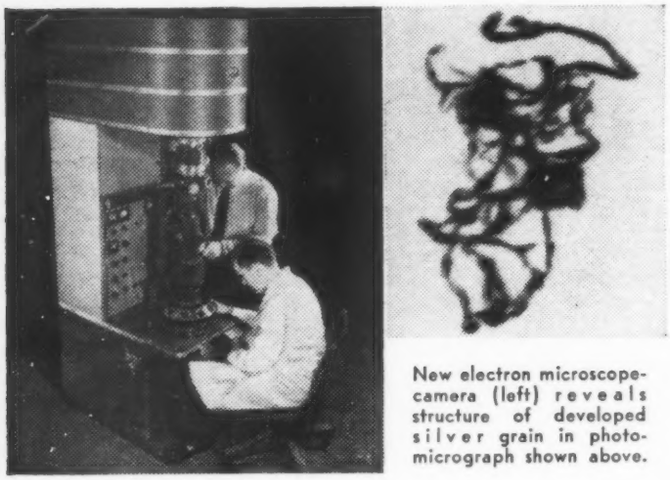
Imagine a negative in which all the silver grains remain separate. Upon projection the general light background would form a gray area in which the individual grains would produce a dusting of lighter spots. Such an area would take on a gray tone lighter than the actual background tone, but there would be no disturbing pattern. On the contrary, when the grains string out and form tangled masses we have a light gray background upon which darker spots are formed by the openings between the grain chains, and the pattern does become obvious. Even so, if the pattern is regular it is not too disturbing; but when the chains become long and tangled, there is an irregularity of distribution of the pattern and the result is a grainy print.

There is an idea that grain pattern is important only in miniature negatives, but this is a mistaken idea. Aside from studio photographers who use cameras of 8x10 size and larger, any negative is subject to projection printing. Not only this, but in many cases almost half the negative is lost because there has been insufficient opportunity for composition, therefore the picture is centered and the edges of the negative are wasted. The average 3¼ x 4¼ negative rarely has more than 2½ x 3½ inches of usable area. To make the usual minimum 8x10 print this means a four-diameter enlargement, and although grain pattern may not be evident at such a degree of enlargement, the crispness of the definition and texture will be injured if there is a hidden grain pattern of objectionable quality.

It is therefore advisable to take due precaution to avoid graininess whenever possible. On the other hand, there is not a need to make use of extremely low-potential developers such as paraphenylenediamine, because such developers avoid graininess at the cost

of considerable quality in the negative. Just what means may be employed to control graininess? This will be discussed at greater length in the next chapter, but at this time we may mention those factors which are related to the physical nature of the negative.

In the first place the graininess of the negative is



New electron microscope-camera (left) reveals structure of developed silver grain in photomicrograph shown above.

largely an inherent factor. This has often been disputed, but the fact remains and has been substantiated by the large research laboratories. Therefore the first step is to choose a finegrain emulsion. The next step is to avoid any developer which has a definitely destructive effect upon the emulsion such as those containing caustic alkali. These developers are usually used with slow emulsions to obtain high contrast, and as such emulsions usually have a fine grain structure the final result is not objectionable. Even the carbonate developers will soften the gelatin sufficiently to permit grain clumping to a greater degree than is acceptable for finegrain work, although it must be added that the developing agent (reducer) itself has a definite effect upon the grain structure. Pyro, for example, with its potential of 16, gives an excellent pattern as a rule. The developer choice, therefore, should be in the direction of the ones using a milder alkali such as the borax types of developer. With these developers metol and hydroquinone are retained for their excellent image-forming qualities. The borax negative is characterized by an excellent gradation, full density, and regular grain pattern. Except for the extreme degrees of enlargement, the borax negative will be found quite satisfactory.

It is obvious that the greater the number of grain chains which are superimposed in various strata of the emulsion the greater will be the chance for apparent clumping. That is, the large clumps do not actually exist, but several smaller clumps in superimposed strata may lie in positions which, when looking through the negative, give the impression of an actual large clump. For this reason it is advisable to keep the exposure to the lowest level which will produce a good image. The absence of overexposure will prevent excessive chain formation in the deeper strata, and give the negative as a whole a grain pattern more in keeping with the actual grain distribution.

Another factor is the maintainance of uniform temperature. If you stick a piece of sponge rubber full of needles and then compress the rubber in various directions the needles will work around through the rubber. Likewise if you haye a sheet of soft, flexible gelatin filled with metallic grains, the kneading process which results from the contraction and expansion of the gelatin under different temperatures will push the grains into contact, and once they are in contact they usually remain. Therefore, a uniform temperature produces a static gelatin condition, and this is a decided help in the prevention of grain clumping.

Resolving Power.

Closely allied to graininess is the resolving power of the emulsion. If you have a pattern of fine lines drawn closely together so that they are separated by white stripes just as wide as the black lines themselves, you will have a test object. It is obvious that as this pattern is removed farther and farther from the camera the image will become smaller and smaller, until finally the lines will no longer be photographed as lines, but the whole area will take on a medium gray tone. This is the limit of **resolving power**—that is, the emulsion can no longer **resolve** (or separate) the individual lines.

We must remember that the line image is not a line, but a very narrow streak made up of a large number of silver grains. If there are excessive chain formations the line will not be sharp, but will be ragged just like an ink line drawn upon a bit of newspaper stock. While this may not be visible in its true form, it will prevent the line from appearing sharp. Therefore we can see that although we may have an objectionable grain pattern, the image will probably suffer even more from loss of sharp definition; in fact we may have a print which lacks definition yet in which the graininess is not visible as such.

Fig. 18 shows one type of chart used for testing resolving power. The central arrow of the original is 11¼" long, and the calibrations along the top and bottom indicate a decreasing thickness of the arrow in single millimeters. The calibration at the side is a centimeter scale for judging changes in size from the original. This chart is set up at any convenient distance and a photograph made. From the negative a contact print is made which will show the size of re-

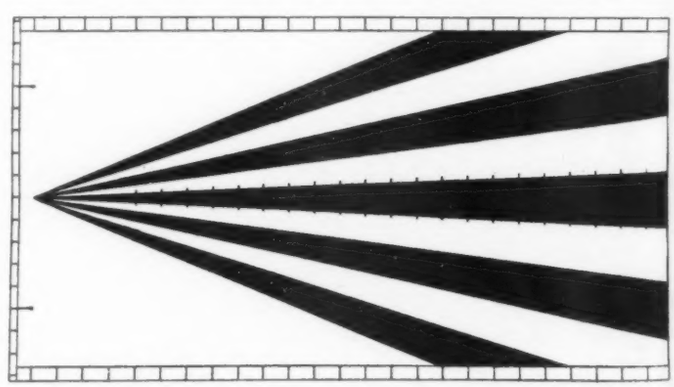


Fig. 18. One type of chart used for testing resolving power.

duction by measurement on the centimeter scale. Next an enlargement is made of sufficient size to show the loss of separation of the lines near the arrow point. The width of the line at this point is measured, and the result is the resolving power. For example, if the contact print shows the copy to be 1/100 the size of the original, and the lines merge at the 3 mm point, then the result shows that the limit of resolving power of the emulsion is 3 mm divided by 100 (the scale of reduction) or 0.03 mm, which is about 1/800 inch.

Resolving power and graininess are closely allied, but there are still other factors in resolving power. For example, there is never an abrupt termination of

density at the edge of a sharp line, but the edge is "feathered," that is, it has a zone of decreasing density which is considerably wider than a sharp edge would be. This happens even when there is no physical contact between grains. One cause is **irradiation**; the light entering is partially reflected from one grain surface to expose a separate but adjacent grain.

Again we must remember that the lens also has a limit to its resolving power, but ordinarily the limit imposed by the emulsion is encountered long before the limit of the lens. This is shown by the fact that when the resolving limit is reached when using ordinary film, the same camera and lens will show a much greater resolution when a slow, finegrain, contrasty emulsion is used. Resolving power is important, and while the rule is by no means absolute, it is found under average conditions that resolving power increases as the sensitivity or "speed" of the emulsion decreases.

A word of warning should be given here. There is entirely too great a tendency on the part of advanced amateurs to blame their failures upon the poor resolving power of the emulsion (or some other technical factor), when in fact the trouble is nothing more or less than blur caused by their own carelessness.

No test of resolving power can be considered as having any meaning unless: 1, the quality of the lens has already been tested; 2, the lens is used at a moderate aperture; 3, focusing has been done with the utmost care using a magnifier for the purpose; 4, the registration of the mechanical focal plane with the optical one has been tested and proven; 5, the camera is fastened firmly to a tripod so heavy that it cannot be made to tremble; and 6, unless the exposure has been somewhat more than merely reasonably accurate.

Just bear this one fact in mind when making tests; be sure that everything which has the least effect upon the result, or which could possibly have such effect, is of definitely known characteristic or quantity. Leave nothing to chance, or your test results will be worthless.

The Negative Image.

The qualities of the negative which we have discussed, its reactions with the developer, and the characteristics of the developer itself all lead but to one thing—the final negative image. The inherent qualities of the emulsion and the influence of the developer are worthless except as their final result affects the latent image impressed by the exposure. We know, of course, that the exposure must precede the development, but too often the intimate relationship between the exposure and development is lost sight of.

There is an old, old rule which says "Expose for the shadows, develop for the highlights." That rule under various guises has been handed down through generations of photographers. Its continued existence is due in part to its fundamental truth, but too often it is interpreted as meaning that there is only the most casual relationship between exposure and development. This is not at all true. Again we often hear "When the exposure has been made, the image is fixed beyond alteration by development." This is also very true, yet untrue! The whole trouble lies in the fact that we only half interpret such statements.

For example, suppose we make an exposure in which the shadow detail is barely recorded in the latent image. Now it is perfectly true that we cannot develop any more shadow detail than the exposure has recorded. But if we develop in a low-potential developer, such as hydroquinone or paraphenylenediamine, we will fail to get an image at all in these shadows. Now the mere fact that one developer can bring out detail in shadows which is not produced by another developer is not a sign that the more energetic developer is bringing up details which were not recorded; it simply means that the low-potential developer is not doing the fullest possible work.

Again we are told that for paraphenylenediamine developers we should give two to four times the normal exposure, because the gentle developer produces a loss of speed in the film. Again trying to put the fault on the film! The fact is that this developer is highly inefficient and will not do the work for which a developer is used. Perhaps the words make no difference, but if you get to thinking that developers can affect inherent sensitivity or that some developers can bring up unregistered detail you will grow into a grave misunderstanding of the fundamental reactions of photography.

Therefore, when you read or hear such statements do not consider them limited by your habitual routine, but consider them as applied to fundamental photographic facts, and you will find yourself free from the confusion which confronts so many amateurs.

The foregoing example of the inability of low-potential developers to reduce the entire image, and the fact that the loss is not evenly distributed but occurs in the shadows, is an illustration of the relationship between exposure and development. How is the condition remedied? By increasing the exposure until the least intense light has affected the emulsion to a degree from two to four times as great as would be necessary if a normal developer were to be used.

On the contrary, if a roll of film is exposed and developed and then found to be underexposed, a change to a developer of higher potential will often work wonders through converting what was an underexposure into a normal one. On the other side of the picture, if films run toward overexposure, the use of a low-potential developer will save them through its lesser activity. Here we see an example of true exposure compensation by development. The warning against this is meant in an entirely different way. You can't overcome underexposure by pushing the time to the limit in the same developer, just as you cannot overcome overexposure by shortening the time of development.

Because of the compressed tone ranges at the toe and shoulder of the characteristic curve, and because a negative lacks contrast in the early stages of development, many amateurs believe there is an irregular rate of density growth during development. This is not true. The rate of growth is proportional to the time of development. That is, during the period required to double the density of any one tone, any other tone will also have doubled in density.

For example, suppose there is a shadow area of density 0.1 and a highlight area of density 1.0 during an early stage of development. The ratio between these two densities is 1:10. If, at a later stage of development, the shadow density grows to 0.2, the highlight area will have grown to 2.0—still a ratio of 1:10. However at the early stage the actual transmissions of the two were 98 and 10 per cent respectively, or 9.8 to 1, while in the second case it was 95 and 1 per cent, or a ratio of 95 to 1—an increase of almost ten times, although the proportionate growth has remained the same. Figure 19 shows the relative increase in density during four and twelve minutes of development for four exposures.

When the image starts to develop, all of the detail

is more or less visible. After that the highlights build more rapidly than do the shadows, so that there is a constantly increasing contrast in the image. We must therefore always keep in mind that a given emulsion developed in a given developer will grow in contrast as the time of development is prolonged. But note that

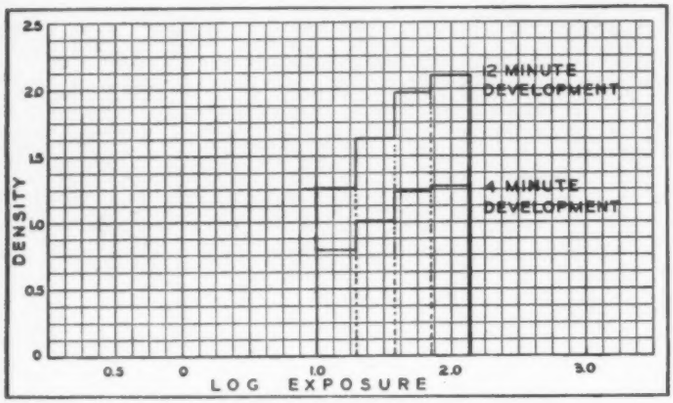


Fig. 19. Diagram showing the relative increase in density during four- and twelve-minute development for four exposures.

changes in film, in emulsion, in developer composition or concentration make the rule void; only when applied to a given set of conditions is the rule necessarily true.

It is true that under a given set of conditions there are definite results to be expected from under- and overexposure as well as from under- and overdevelopment. Referring to the early part of this discussion we saw that a quantity of light smaller than is required for the full exposure of the emulsion throughout its depth, will expose a certain proportionate part of the emulsion, which exposed portion may subsequently be developed. It was also learned that a certain minimum exposure is necessary to produce any effect whatsoever. With these two points of departure we may investigate the mechanism of exposure plus development.

Exposure and Development.

When any ordinary scene is photographed, the range of light intensity in that scene will usually take up the full capacity of the emulsion to handle under- and overexposure. That is, the shadows will be barely strong enough to make the faintest impression, while the highest intensities will be strong enough to expose the emulsion throughout its depth. It is obvious that to match the range of light intensities to the potential range of the emulsion the exposure must be controlled with reasonable exactitude. When this is done the developed negative will show the faintest trace of silver deposit in the deep shadows while the highlights will have full density.

Assuming that such a scene is available, we shall further assume that nine films are exposed with this scene as the subject. Three of these will be underexposed, three will be correctly exposed and three will be overexposed. When these films are to be developed they will be divided into three sets, each set containing one each of the test exposures. One set will be underdeveloped, one set will be normally developed, and one set will be over-developed. Now if we use the code letters **U** for **under, N** for **normal, O** for **over, E** for **exposure,** and **D** for **development,** we can arrange the set of nine negatives, after development, in this manner (Fig. 21):

	Under-exposed	Normally Exposed	Over-exposed
Underdeveloped	**UE-UD**	**NE-UD**	**OE-UD**
Normally developed	**UE-ND**	**NE-ND**	**OE-ND**
Overdeveloped	**UE-OD**	**NE-OD**	**OE-OD**

It will be noticed that the central negative, **NE-ND,** is the only one in the nine which may be said to be correctly handled throughout. Taking these nine negatives one by one, we should expect to find the characteristics as listed in the following paragraphs.

UE-UD. The underexposure will have failed to register shadow detail, so the shadows will be blank. The highlights, unless unusually brilliant in the original, will not be of full density but will be obviously thin because there has not been sufficient development to bring them up to full strength even though they were fully exposed. In any exposure error, the error usually extends only to one set of values. In underexposure the shadows are underexposed but middle tones and highlights are not. In the normal negative all shadows have actually been underexposed and all highlights have been overexposed. Thus it is possible to have fully exposed highlights in an underexposed negative.

NE-UD. This negative will show detail in the shadow except for the extremes of deep shadow. This shows that the necessary exposure has been given. At the same time the highlights will be of too low

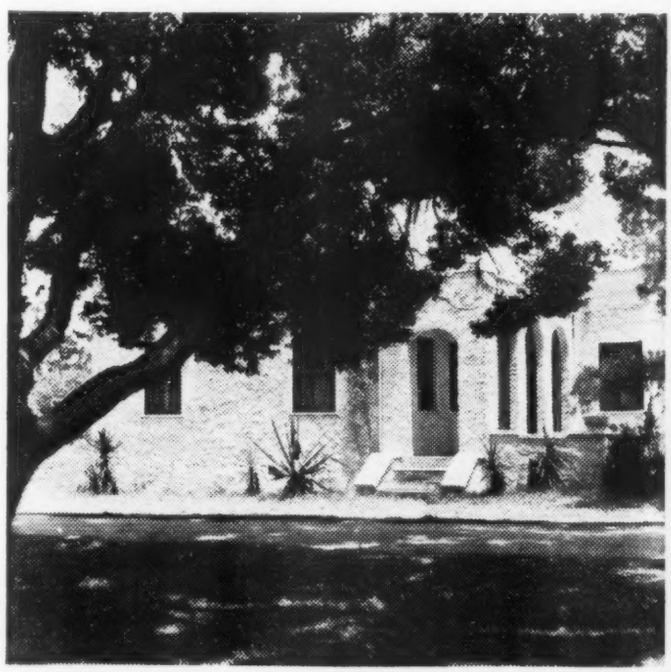


Fig. 20. In a print from the NE-ND negative, detail is preserved in both shadows and highlights unless they run into extremes.

density, showing the lack of complete development. This will be a soft or flat negative, i.e., one lacking in proper contrast. If the underdevelopment is serious there may be patches showing varying degrees of development.

OE-UD. This negative is typical of the attempt to salvage a known overexposure by removing it from the developer too soon. There will be full detail in the deepest shadows, while the highlights are but slightly darker than the shadows. The entire negative is heavy and almost too opaque to reveal the image when ex-

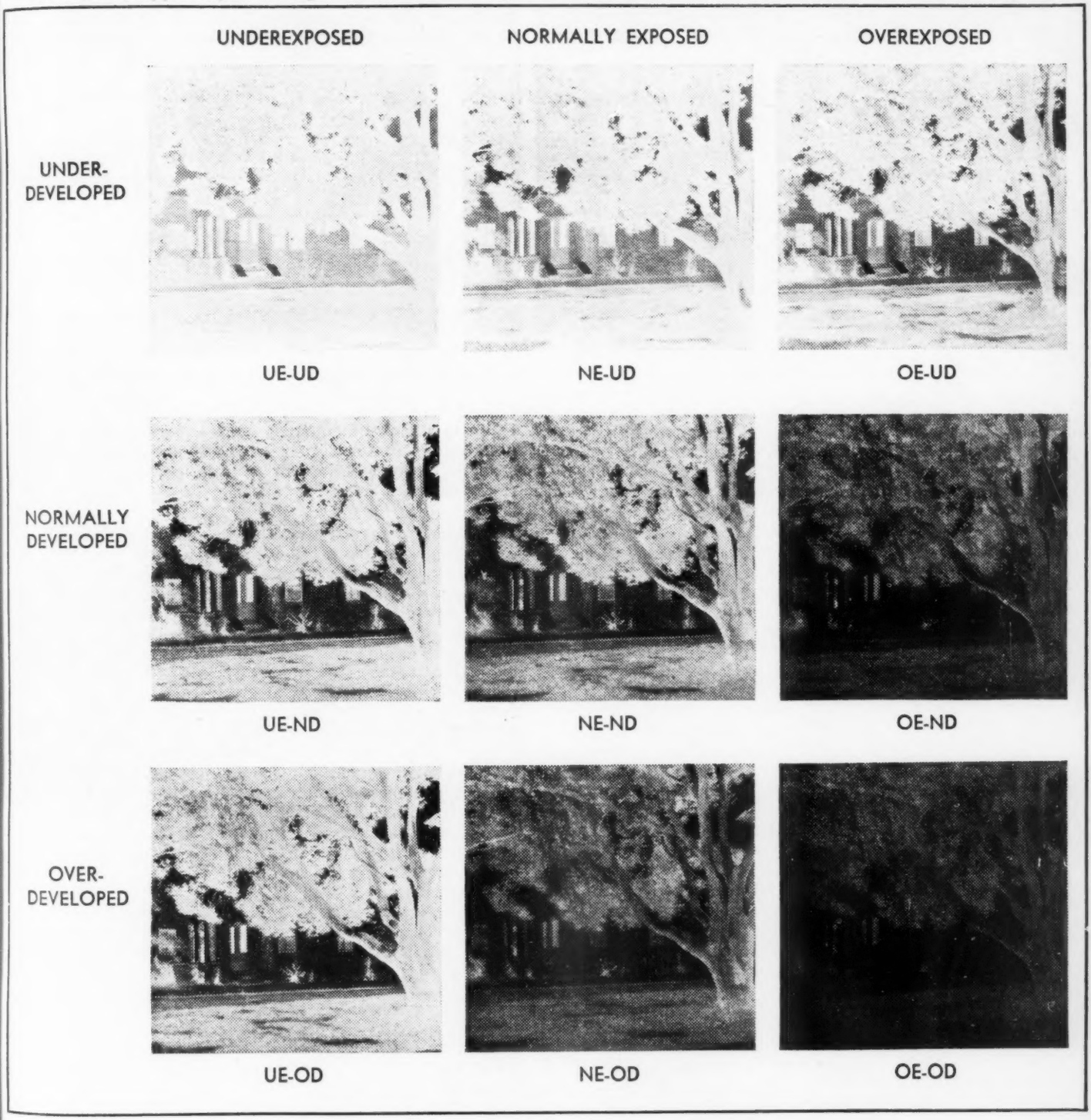
amined by transmitted light. Such a negative should be developed to full strength and then submitted to the action of a reducer. Fig. 22 shows a print from this negative.

UE-ND. This negative will show blank shadows, but the highlights will be full strength. This produces an impression of excessive contrast and may be called overdevelopment. However, the absence of shadow tones and the full strength highlights tell the story of underexposure. Such a negative will actually print better if it has a deposit of uniform fog.

NE-ND. This is the most difficult negative to describe. There should be a delicate but definite record of detail in the deep shadows. There should also be unmistakable detail in the highest light. For example, a photograph of a girl wearing a white dress should

EXPOSURE AND DEVELOPMENT

Fig. 21. The left-hand column of negatives received an exposure about one-fourth normal, the center column was normally exposed, while the right-hand column received four times normal exposure. The top row received one-third normal development, the center row was normally developed, while the bottom row was given three times normal development. Code letters appearing under negatives refer to their exposure and development; characteristics are discussed in the text.



show the folds, the seams and other details of the white dress. The highest light should be just dark enough that when the negative is held up before a newspaper (not laid upon it), the paper can with some difficulty be read by looking through the highlight. This is a crude test but one easy to apply (See Fig. 20).

In this example the negative is thick and so uniformly black that the image can hardly be seen, much less be observed closely enough for criticism. If it were examined, the image would show that there had been an initial excessive contrast, followed by loss of contrast as the shadow detail built up far below the minimum. In this case, even with overdevelopment there is a lack of contrast because every tone in the negative is at least half strength, and the available emulsion is only sufficient to produce half the normal range of tones. (See Fig. 23.)

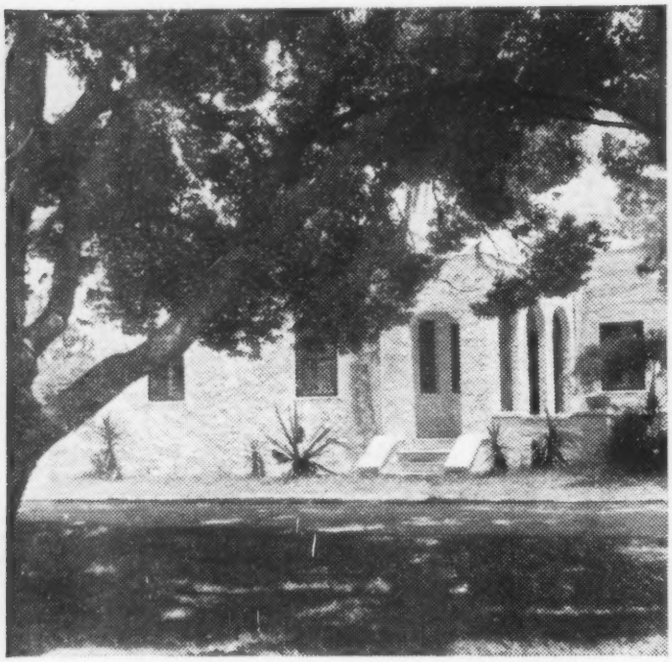


Fig. 22. Extreme contrast is lost in print from OE-UD negative. Shadows indicate brilliant sun; highlights suggest a hazy light.

Fig. 23. Print from OE-OD negative. Light shadow detail gives false sense of luminosity. Light tones in building are lost.

OE-ND. This negative resembles the preceding one at first glance, but examination shows the shadow details are too strong, the highlights practically opaque, and the entire negative has a heavy, blackish appearance. The normal negative has an unmistakable delicacy of tone quality which is lacking in this one.

UE-OD. This is a beginner's negative. It seems to have but two tones—the clear base of the shadows and the inky black of the highlights. It is this "soot-and-whitewash" appearance which serves to distinguish it from the preceding two underexposures. Such a negative is practically beyond redemption, and the best remedy is to make it all over again.

NE-OD. This is the "snappy" or "brilliant" negative so well liked by the beginner. It looks a lot better than the normal negative, and the beginner can hardly believe his senses when it fails to produce a good print. The fact is that while it may be an excellent negative record of the original subject, it has a contrast range so great that it cannot be printed. Attempts to print it throw several of the shadow tones into pure black and most of the highlight gradation which produces highlight detail is blocked up and the object prints as a white silhouette.

OE-OD. This negative resembles a classic photograph—that of the black cat in the cellar at midnight!

These characteristics can be seen by the experienced photographer. Underdevelopment may sometimes resemble underexposure so closely that without knowing the exposure conditions it would be risky to make any definite statement. Likewise overdevelopment of a fully exposed film may produce a negative which the expert would pronounce as a definite overexposure. Therefore it isn't wise to be too sure of a diagnosis until all the data are known. However, the foregoing will serve to identify the labels of the eight serious errors in the exposure-development complex, and if the amateur were to make such a set of negatives deliberately and keep them for study he would learn more practical photography than from reading a library of books or attending a lifetime of lectures.

As we shall stress from time to time, it is advisable to study in order to identify guideposts, but the actual **learning** is only done by practical experience and experiment.

If you really want to learn to make negatives, make them and learn. In our next discussion we shall leave theory behind and get into the actual procedure of developing a negative.

Part Two (Chapter III) of "The Photographic Negative" will appear in the September issue of POPULAR PHOTOGRAPHY. In this section Mr. McKay discusses darkroom design, equipment, and technique.

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